DOCUMENT RESUME

ED 212 465 SE 036 042

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TITLE Math Anxiety: A Research Report.
PUB DATE Nov 81
NOTE 97p.; Paper presented at the Annual Meeting of the Mid-South Educational Research Association (10th, Lexington, KY, November, 1981).

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *College Freshmen; College Mathematics; Educational Research; *Elementary School Teachers; Elementary Secondary Education; Higher Education; *Mathematics Anxiety; *Mathematics Education; Mathematics Instruction; *Middle Schools; Models; Student Attitudes; Undergraduate Study
IDENTIFIERS *Mathematics Education Research

ABSTRACT

Presented are the following reports: (1) Math Anxiety: Real and Complex; (2) Math Anxiety and Middle School Students; (3) Math Anxiety and College Freshmen; (4) Math Anxiety and Elementary Teachers; and (5) Math Anxiety: Conclusions, Discussions, and Remedies. The studies attempt to answer questions regarding mathematics anxiety: (1) what is it, (2) who has it, (3) why do people have it, and (4) what can be done to prevent or cure this anxiety? Anxiety was measured by a standardized rating scale and information on related variables was determined by a standardized test and an investigator-developed questionnaire. Findings are presented separately for each study. Among the conclusions are: (1) group membership has little impact on a person's anxiety unless the group membership reflects actual mathematics performance or an attitude towards mathematics; (2) persons with high anxiety perceive their mathematics skills as less than their other academic skills and generally will not like mathematics or enjoy teaching it; (3) motivation and successful experiences have high degrees of association with mathematics anxiety and great impact on successful completion of mathematics tasks; and (4) performance of a task and teaching of a skill are not necessarily equivalent in creating anxiety for a particular individual. A model of a mathematics anxiety reduction seminar is included. (MP)

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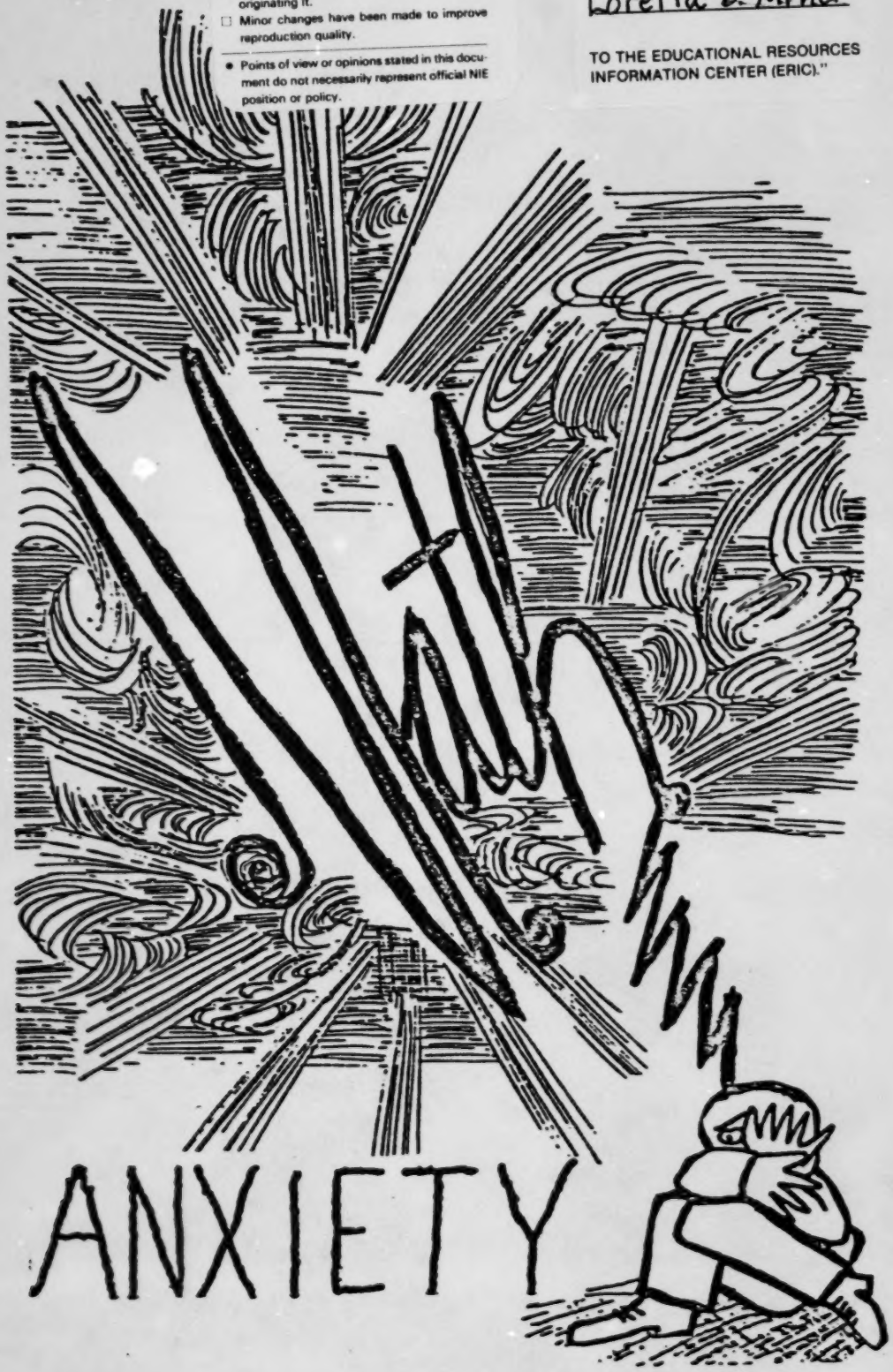

SE 036 042

IDENTIFICATION DATA

Report Title: MATH ANXIETY: A RESEARCH REPORT

This report consists of five professional papers:

1. Math Anxiety: Real and Complex. . .
2. Math Anxiety and Middle School Students
3. Math Anxiety and College Freshmen
4. Math Anxiety and Elementary Teachers
5. Math Anxiety: Conclusions, Discussions, and Remedies

Authors: Donald E. Wright and Loretta Diane Miller

Report Presented: Mid-South Educational Research Association
Tenth Annual Conference, November 1981, Lexington, KY

Report Refereed by Program Committee: John R. Petry, Chairman
Bureau of Educational Research
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Report Previously Published: A synopsis of the report was published in the 1981 proceedings of the MSERA Tenth Annual conference.

A summary article was published in Impressions, a publication by Arkansas State University's Department of Educational Administration and Secondary Education, Vol. IV, No. 2, Fall 1981

Descriptors: Math Anxiety, Math Education, Teacher Education

FORWARD

Developmental Mathematics instructors are faced with the awesome task of helping college students become proficient in basic skills which they should have acquired years before. Within one classroom, the students' abilities range from those who cannot perform the four basic operations (addition, subtraction, multiplication and division) with whole numbers to those who are proficient in the manipulation of numbers but not in being able to solve a reading comprehension problem.

One variable which seems to be an influencing factor as to how well a person performs in mathematics is "math anxiety." As an instructor of Developmental Mathematics, I became very interested in the "whys" behind my students' inabilities to perform basic computational tasks. I felt competent in attacking the problem in the cognitive area, but felt like the basis of developmental math students' deficiencies lay in their attitude toward math, not their aptitude.

For two years, I concentrated on the affective domain. I incorporated individualized instruction into the classroom because it was conducive to an informal atmosphere. Students were encouraged to discuss their feelings about math; past experiences, their present endeavors, and future aspirations. They were told to take-a-break when frustration made further work unprofitable. Students were allowed to take active part in planning their course of study, but had to present their rationale for wanting to avoid a particular topic. Group counseling, individual counseling, and other techniques were employed in trying to improve the

students' attitudes toward mathematics and themselves in general. Comments made on end-of-semester evaluations indicated that those students who had maximum progress in their basic skill competencies had done so because they now possessed a better attitude toward mathematics.

A taste of partial success gave me the desire to learn more about math anxiety. Everything I had done the past two years had been informal and nonstructured. I shared my concerns with a colleague. We decided to pool our resources, combine our efforts, and answer some questions many people in our area were asking: (1) What is math anxiety? (2) Who has math anxiety? (3) Why do people have math anxiety? and (4) What can be done to prevent and/or cure math anxiety?

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MATH ANXIETY: A RESEARCH REPORT

An Abstract

The studies in this report investigate math anxiety and related variables at three separate and distinct levels; the middle school, college freshmen, and teacher education majors and graduates in elementary education. Math anxiety of the participants was measured by a standardized math anxiety rating scale and information on the related variables, i.e., math achievement, attitude toward math, teaching experience, was determined by a standardized test and an investigator developed questionnaire. The results were compared utilizing statistical techniques and the findings were presented for the separate studies. The report also contains a review of literature and the investigators' proposal of a synthesized hypothesis regarding math anxiety and procedural techniques for reducing this anxiety at both the middle school level and post-secondary level.

MATH ANXIETY

A Research Report

BY

Don Wright and Diane Miller
Arkansas State University

A Symposium presented at
The Annual Conference of the
Mid-South Educational Research Association
Lexington, Kentucky: November, 1981

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MATH ANXIETY: REAL...and Complex

A professional paper presented as Part I

of a Symposium: Math Anxiety: A Research Report

Presenter

Diane Miller

Annual Conference of the

Mid-South Educational Research Association

Lexington, Kentucky: November, 1981

Math Anxiety···REAL and Complex

Math anxiety is real. It is not a figment of anyone's imagination, or is it? Math anxiety is not real in the concrete sense. A person cannot hold it, beat it or conquer it through physical means. Math anxiety is real in a person's mind.

Math anxiety is not imagined. It is a real tension that interferes with a person's ability to solve math problems. Or is it a real feeling that a person must possess before one can manipulate numbers and work problems?

A person with a high anxiety may perform poorly in a math class. However, people who have scored very low on a math anxiety rating instrument, have also done poorly in math classes. Likewise, people with little or no anxiety do very well in math in the same classroom with someone who has a high anxiety and also does well.

Math anxiety is not sexist or prejudiced; it can significantly influence anyone's life. Even someone with a terminal degree can suffer with math anxiety; and the complexity is, that everyone should, to a certain degree.

The first paper presented is a review of the literature conducted in the summer of 1980. This search preceded the field study portion of our project so that we could better surmise what had been done and where we should start.

INTRODUCTION

In an increasingly technological society, knowledge of mathematics is critical to the pursuit of many existing and emerging occupational fields.[1] In addition to its necessity in scientific and technical fields, knowledge of math is increasingly important in business, the social sciences, and the humanities. In spite of the importance of math, many intellectually capable students avoid taking math courses in high school and college and, consequently restrict the range of careers from which they may choose to those which do not require quantitative skills. Many other students fail to perform as well in mathematics as they are capable and, again, do not attain the math knowledge which would expand the range of career options available to them.

WHAT IS MATH ANXIETY?

Math anxiety involves "feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations."[2] Burton defines anxiety in general as an unpleasant state which produces acute discomfort that is most often associated with an object of high value.[3] Solving a math problem or learning from a book and teacher requires concentration and clear thinking. Information must be taken in by paying close attention to what is written or said. It is also necessary to remember what has been learned so that the next

topic can be understood. Unfortunately, anxiety seriously interferes with memory, attention and concentration. As anxiety is reduced, one should be able to remember more and become more confident with the math concepts retained.

Tobias tags math anxiety simply as the "I can't" syndrome.[4] Mathison feels that it is an irrational fear which interferes with the development or use of mathematical skills.[5] Kogelman and Warren view a difficulty with math as a problem with attitude rather than aptitude. It is an emotional, not intellectual inhibition, that can be overcome.[6] Both believe it to be an intense, emotional reaction to math based on past experiences.

After extensive observation and testing of two groups of students, Morris and colleagues concluded that anxiety consists of two separate components: worry and emotionality.[7] Worry is a cognitive concern about performance and its consequences. It varies as a function of performance expectancy, test importance, perceived difficulty of the test, and feedback conditions.[8] Emotionality is a physiological and affective arousal. It is much less consistently affected by such cognitive considerations and varies as a function of conditions.[9]

WHO HAS MATH ANXIETY?

The review of the literature revealed that people with math anxiety range in age from nine to sixty-five. Participants of various studies ranged from high school drop-outs to Ph. D.'s in the humanities, representing a variety of cultural and ethnic backgrounds. Math anxiety seems to exist among many individuals who do not ordinarily suffer from

any other tensions. Thirty-three percent of the people attending one behavior therapy program indicated that everyday tension and anxiety resulted most often from routine activities that involved mathematics: handling money, balancing a checkbook, evaluating sales prices, etc.[10]

In one study, nine to eleven year-old children, who were underachieving in mathematics, demonstrated that anxiety was the most significant contributor.[11] Poor self-esteem is a proven consequence of math anxiety which results in poor performance and underachievement.[12] To prevent maximum damage to a student's self-concept, math anxiety must be conquered in the early years of intellectual development. However, some of those who suffer most acutely from math anxiety are elementary-school teachers.[13] This is most unfortunate because a teacher's attitude is a potent force in the classroom. One conclusion drawn from a survey of 124 dissertations written from 1969-75 was that teachers' attitudes and their enthusiasm toward a subject have greater impact on students' attitudes than instructional variables do.[14]

The review of the literature revealed that math anxiety is particularly prevalent among female and nonwhite students. Kogelman and Warren went so far as to estimate that of those suffering with math anxiety, two-thirds are women.[15] Stroup and Jasnoski found that boys generally perform better than girls in math, but only after the sixth grade.[16] They suggest one reason behind this phenomenon is puberty. Girls enter certain stages of development before boys; therefore, they become aware of sex roles and do not want to appear masculine, which a talent in math has been labeled. Girls begin to avoid math as a way of managing this clash between popularity and performance. This

avoidance is thought to be a symptom of math anxiety when it is actually a part/result of our social structure.

Avoidance of math, particularly in the secondary school years, is very damaging when one selects a career. Participation of women in the scientific and technological fields is disproportionately low compared to other professional areas of concentration.[17] Many studies have strengthened the conclusion that mathematics acts as a "critical filter." It tends to eliminate women from many professional opportunities involving skills in math and science.

However, some girls do complete the college-bound, math concentrated, high school program and are labeled "talented women." As a group, talented women interested in science careers report average math anxiety and higher than average math interest.[18] Stroup and Jasnoski concluded that talented women do not generally avoid math because they are anxious. These women do not fear failure in math, which is an important aspect of math anxiety. One reason for the trend toward math avoidance and underenrollment early in a talented woman's college career may be a fear of success, or a fear of the negative consequences of achievement.[19] More explicitly, talented women may avoid math because they fear what their success may cost them and not because of their fear of failure.

The review of the literature resulted in only one study having been done concerning math anxiety in nonwhite students. Participants were American Indian students. Results of the study indicated that math anxiety and math avoidance are the most serious obstacles to

general education and to the choice of scientific careers for the American Indian.[20]

The primary reason for undertaking this study was to determine the extent to which math anxiety is prevalent in college students. The review of the literature suggests that math anxiety exists in our college population and involves feelings of tension that can interfere with a student's learning of basic mathematical skills. The literature review also substantiates that students who must take a remedial math course in college have frequently met failure in math courses or have avoided math for a period of years. These persons generally suffer with math anxiety and have a poor attitude toward math. Math anxiety also plagues graduate students. A number of volunteers for one math anxiety treatment center were graduate students who were having difficulty with the relatively small but significant number of math formulations in their area of specialization.[21]

Doyle and Graesser conducted a study using math anxious and math comfortable college students in which they were trying to determine if the math anxious students exhibited characteristics distinguishable from the math comfortable students. The following describes some traits that Doyle and Graesser deem characteristic of highly math anxious students: (1) They not only panic but also have an overwhelming belief that they cannot solve any kind of problem entailing math; (2) They express the belief that the problem they are trying to solve has a simple solution, but that they are too dumb to see it; (3) They frequently express frustration because they believe that they should know how to solve the problem; and, (4) Some even express

aversion as well as apprehension to entering the building where math is taught.[22]

In other readings, Betz agrees that math anxiety occurs frequently among college students, more often among women than among men, and more often among students with inadequate high school math backgrounds.[23] In 1966, 14% of entering freshmen entered college with only two years or less in high school math; in 1976, 25% had two years or less.[24]

A sample for one study was comprised of students enrolled in first level required math courses in three types of post-secondary institutions in the midwest: a state university, a technical institute, and a community college. It consisted of 320 males and 100 females. The analyses revealed that a majority of the subjects (58%) held attitudes toward math that were significantly negative ($p < .05$).[25] Males held more positive attitudes. Participants were divided into two groups by age: under twenty-three which should include the students in the regular "college-age" group, and over twenty-three which should include adult learners. The older group held more positive attitudes. The study completely supports the hypothesis that attitude is an important influencing factor in determining the degree of which a person suffers math anxiety.

WHY DO PEOPLE HAVE MATH ANXIETY?

The activity of mathematics itself appears to generate anxiety reactions among a number of people who are not necessarily highly anxious in other situations.[26] Burton contends that the nature of the

subject itself, coupled with the lack of a firm foundation in mathematics, often gives rise to math anxiety.[27] Another explanation is that the ability to do math beyond computations is correlated with the ability to do spatial relations.[28] (Spatial relations tests usually show two or three-dimensional objects in one view and require that another view of the same object be "visualized.") Therefore, people with below average spatial relation abilities tend to have difficulty in learning advanced mathematical concepts.

Research conducted in the math anxiety program at the University of Minnesota suggests two factors which interact to produce the phenomenon of math anxiety: (1) past experiences with mathematics education (the most common); and, (2) moving or illness, a person gets behind and never catches up.[29] Other studies support the hypothesis of past experiences being a contributing factor through the effect of teacher influence. Rosenbaum cites a reason for the failure of traditional math teaching to the passive, if not negative, attitude of teachers.[30] Math teachers have a reputation of being hard. A generalized negative opinion about people associated with mathematics exists in our social structure.[31]

Norton and Poffenberger have found that the development of attitudes toward math is a summatory phenomenon with each conditioning experience building upon the one that precedes it.[32] The initial attitudes seem to be developed in the home and are affected not only by parents, but by all the teachers of mathematics with whom the student is associated. Pupils who have done poorly or failed math have deflated egos and therefore tend to develop attitudes of dislike and

hostitility toward math. Indicative of findings reported throughout this paper, a poor attitude seems to breed math anxiety.

The compulsory and rigidified nature of mathematics learning also facilitates math anxiety. Students preceive math course requirements as being beyond their abilities. Insistance on the right answer as quickly as possible makes people nervous. Three reasons why people have math anxiety as expressed by Tobias in Overcoming Math Anxiety are: (1) People feel a sudden death hopelessness in not being able to understand a concept; (2) People become frustrated with their inability to handle math even when they can cope with frustration in other areas; and, (3) The verbal ambiguities which particularly frustrate the verbally gifted student; such as, the "multiplication" of fractions, which results in smaller ones, "dividing" which results in larger ones, "adding" positive and negative numbers when one actually is "subtracting" or "subtracting" when one is actually "adding." The verbally gifted person may turn away from mathematics precisely because it is not "orderly" at least as far as language is concerned.[33]

One cause of math anxiety in women is the perception of math as being a masculine pursuit.[34] This message comes from teachers and society and may begin as early as elementary school. Other factors which contribute to female math anxiety have been identified as: teachers' sexist expectations, scarcity of female mathematicians as role models, sexist mathematics curriculums, lack of parental encouragement, early failure experiences in math courses, and a fear of competition with males in a traditionally masculine discipline.[35]

HOW DOES MATH ANXIETY EFFECT A PERSON'S LIFE?

Generally speaking, if an individual is functioning at a level of arousal that is higher or lower than optimum for a particular task, performance on that task is impaired.[36] Math anxiety is postulated to affect both the extent to which a student pursues any more than the minimally required amount of math training and the extent to which a person is able to learn or perform math skills and concepts.[37]

Hendel found that being anxious about mathematics can have a variety of effects, ranging from an occasional feeling of uneasiness to an overwhelming anxiety which prevents a person from applying for a job which requires doing math.[38] The effect on career aspirations seems to be the most damaging result of math anxiety. A study at Berekely found that of the freshmen admitted in 1972, 43% of the males and 92% of the females had not taken four years of high school math.[39] The study reported that this much math is required of fifteen of the twenty majors at Berkeley. Those students had limited themselves to only 25% of the possible majors offered. The stark reality of the severity of math anxiety in this aspect of a person's life is shocking to this math educator. All efforts possible should be made to conquer math anxiety.

WHAT CAN BE DONE TO PREVENT AND/OR CURE MATH ANXIETY?

There are two positive facets about math anxiety; it is curable at any stage; and, its hold is never irreversible.[40] First, a person must admit that the anxiety exists and next, become specific about its origin and severity. Anxiety can be "cured" by counter-conditioning. One such technique, which has been useful in alleviating

math anxiety, is desensitization.[41] This process includes practicing deep muscle relaxation and simultaneously visualizing a mildly anxiety-producing situation. It is not unusual for anxiety to occur in intellectually demanding situations. People must accept occasional anxieties and not let them become debilitating. The aim should not be to avoid all anxiety-producing situations. This type of avoidance behavior often compounds the problem rather than alleviate it. People must learn to understand their anxieties, to cope with them, and keep them in proper perspective.

Kogelman and Warren feel that a person cannot decrease anxiety by fighting it. One must first accept the state of being anxious and then do something about it. A person should write down and/or discuss their feelings about math.[42] This experience enables one to gain new insights into how to relate to math. Teachers can help dispel negative feelings about math by helping a student find out what question he/she is answering, if it is not the one asked. Just being told an answer is wrong only serves to make a pupil feel bad. If a student can learn what questions are being answered, he/she can also learn the right answers to questions being asked.

Changing math instruction can also help to alleviate math anxiety. Some successful attempts at math instruction for Indian students employ a supportive atmosphere for learning: individualized, non-competitive programs, tutorials, math anxiety clinics, exposure to Indian role models, courses with an applied focus directly related to a career or community need, and initial math skills education based on everyday mathematics.[43]

Kerber's study resulted in two proposals for curriculum changes to help prevent and/or cure math anxiety. They are: (1) At all levels of introductory math, from basic math to introductory Calculus, there should be a special section addressed to hesitant students and chronic math avoiders; and, (2) Math clinics should be opened for drop-ins and people with immediate or remedial math problems.[44]

Mathison cited three methods of dealing with math anxiety: remediation, content manipulation, and an integrated approach involving both math coursework and psychological intervention. Remediation seems to be most useful when the student's anxiety is tied to a specific level of math or where the student's anxiety level is relatively low. Content manipulation is based on the philosophy that restructuring the material will make it more easily understood and will lesson anxiety. Techniques employed include math labs, individualized instruction, anxiety discussion sessions, and math games. Content manipulation is most successful when anxiety is low. The integrated approach is most useful when dealing with a range of anxieties and levels of math.[45]

Although Kerber and Mathison both regard remediation as a means of over-coming math anxiety, other findings do not indicate that anxiety can be changed significantly in a remedial class. Freeman studied two groups of students, both enrolled in remedial classes, but with one receiving behavior modification procedures specifically designed to reduce anxiety and to improve the student's attitude toward math. The results did not indicate that the degree of change was significantly greater for students in the treatment group than for the control group.[46]

What can college personnel do to resolve the dilema? Campus programs need to be initiated which incorporate a variety of techniques; counseling, desensitization, and special classes. The Mathematics Anxiety Rating Scale (MARS) scores have been shown to decrease among clients volunteering for the treatment of math anxiety as a function of systematic desensitization, accelerated desensitization, and anxiety management training.[47]

A math anxiety program at the post-secondary level should contain four components: (1) A math anxiety diagnostic clinic; (2) Math classes; (3) Math anxiety support groups; and, (4) Math tutorial sessions.[48] Within these four components, techniques to employ to help lesson anxiety intensity include: (1) Build an atmosphere in which students are not afraid to ask "dumb questions"; (2) Teach math content using methods that students can identify with; use concrete examples; (3) Talk about personal math difficulties; and, (4) Allow students to work together.[49]

The review of the literature revealed that every math anxiety program attempted proved successful. However, one study indicated that maximum achievement can better be attained when the program is conducted outside the math department. Reasons given included: (1) Some students are afraid of math to the extent that they will not enroll in any course associated with the math department; and, (2) In order for students to speak freely about their fears, they must feel at ease with their fellow students, and it would be easier to have a atmosphere conducive for such discussions outside the math department.[50]

One factor that causes math anxiety which was mentioned earlier in this report was spatial relations. No program reviewed included this aspect in math anxiety treatment. However, if there is some link between good spatial relations ability and math learning, then one of the objectives of a math anxiety clinic might be the teaching or perfecting of spatial relations ability.

SUMMARY

Mathematics is the primary root of all the evils which beset students in their search for a career, career change, or career updating. Teachers using flash cards and insisting on the right answer fast scare children at age six. Our culture begins to condition young ladies at age thirteen that mathematics is not a feminine career to pursue. However, at age eighteen, twenty-eight, or thirty-eight they are faced with selecting a career, without a mathematics background, from a field of careers in which at least 75% require mathematics.

Teachers are the most important educational influence on students' learning mathematics. When women are encouraged to study the same amount of mathematics as men, differences in learning math will diminish. Many educators strongly believe that if the amount of time spent learning math could somehow be equated for females and males, educationally significant sex-related differences in math performance would disappear.

Math anxiety is not sexist or prejudice; it can significantly influence anyone's life. Most of the research dealing with the

relationships between anxiety, attitudes, and achievement in mathematics has been done in grades one through twelve. Up until the mid-seventies, practically no research had been done on non-mathematics majors who are required to take mathematics courses in college. The overall conclusion from this study is that math anxiety is a threat to our society's intellectual advancement. Educators should start early, in the formative years, to conquer math anxiety. For people who are past this point, colleges and universities should include math anxiety treatment programs as a part of their curriculum.

FOOTNOTES

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MATH ANXIETY and MIDDLE SCHOOL STUDENTS

A professional paper presented as Part II

of a Symposium: Math Anxiety: A Research Report

Presenter

Don Wright

Annual Conference of the

Mid-South Educational Research Association

Lexington, Kentucky: November, 1981

MATH ANXIETY AND MIDDLE SCHOOL STUDENTS

This study focused on the relationship of math anxiety and math achievement in the middle grades of seven and eight. The mathematics sub-test (total math) of the SRA achievement series (1978-form F and G), and the Mathematics Rating Scale-A (1979) were used for data collection.

The study groups of students were randomly selected from sections of mathematics assignments in a consolidated public school system. One section each was selected from (1) advanced math sections; (2) regular math sections; (3) traditional remedial math sections; (4) special project remedial math sections with a self-contained concept; and (5) special project remedial math sections with a departmentalization by skill concept (two teachers). The size of the classes ranged from 20 to 26. Table I presents the specific identifying information on the groups.

The special project mathematics was a federally funded project specifically designed to match-up math task with math skill to establish student success in mathematics thus enhancing student achievement in mathematics.

Although the primary focus of this study was on the math anxiety/math achievement relationship, it was of interest to document the achievement gain in mathematics by the individual groups. Figure 1 presents these data for grade 7. These results reveal that only the advanced math section reported a mean achievement score above the standardized mean with all other sections below the mean. Additionally,

TABLE 1

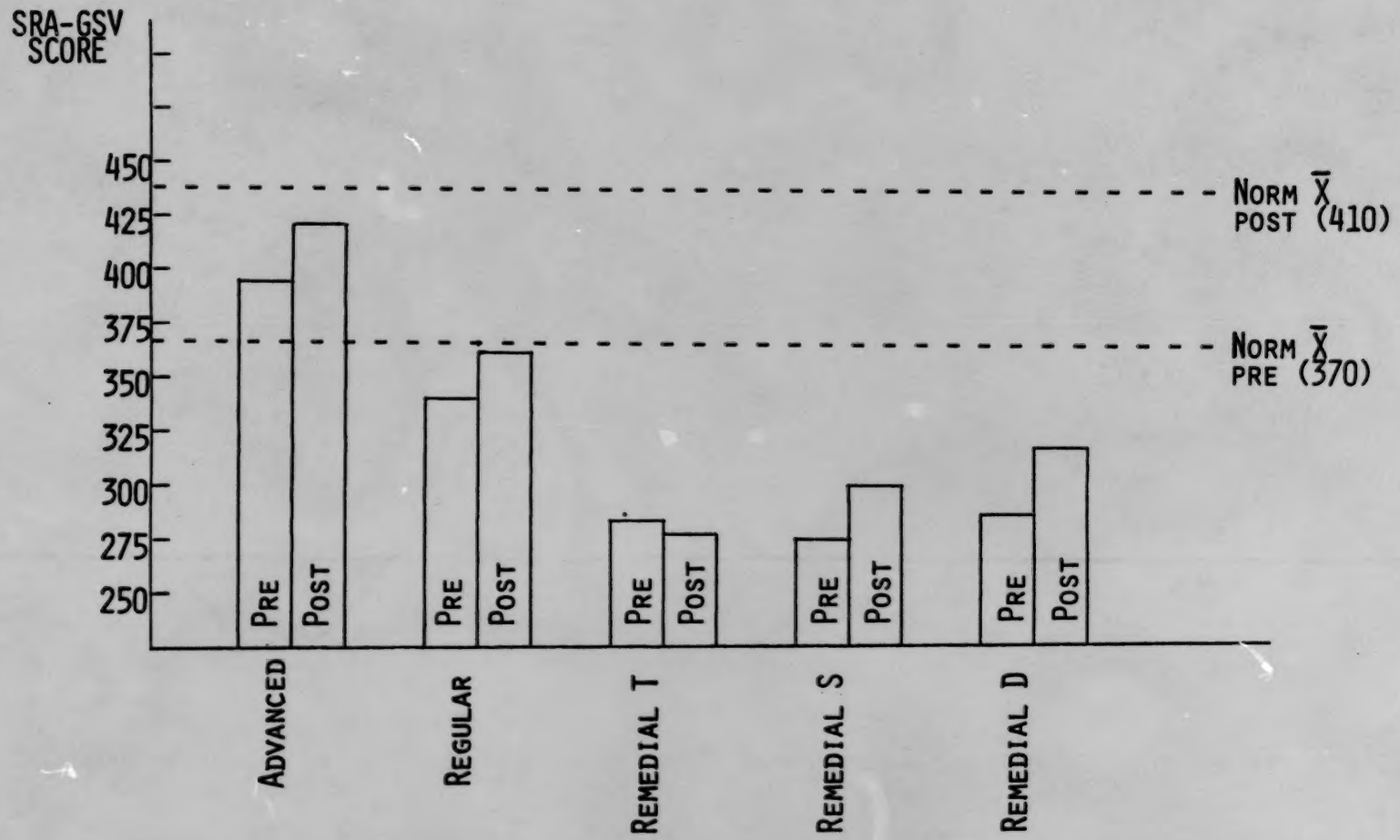
IDENTIFYING INFORMATION FOR STUDY SAMPLE

SERIES 070 - - - GRADE 7
SERIES 080 - - - GRADE 8

GROUPS		N
071	7TH GRADE ADVANCED MATH	26
072	7TH GRADE REGULAR MATH	23
073	7TH GRADE REMEDIAL MATH (T)	22
074	7TH GRADE REMEDIAL PROJECT MATH (S)	24
075	7TH GRADE REMEDIAL PROJECT MATH (D)	23
TOTAL		118
081	8TH GRADE ADVANCED MATH	22
082	8TH GRADE REGULAR MATH	25
083	8TH GRADE REMEDIAL MATH (T)	25
084	8TH GRADE REMEDIAL PROJECT MATH (S)	25
085	8TH GRADE REMEDIAL PROJECT MATH (D)	20
TOTAL		117

T=TRADITIONAL REMEDIAL MATH
S=SPECIAL PROJECT REMEDIAL MATH--SELF-CONTAINED
D=SPECIAL PROJECT REMEDIAL MATH--DEPARTMENTALIZED

FIGURE 1
SUMMARY OF PRE- AND POST-TEST RESULTS
SRA/GSV MATHEMATICS SCORE MEANS
7TH GRADE GROUPS



statistical t-test comparisons revealed that all groups, except the traditional remedial math group, made significant gains in mathematics achievement. Figure 2 presents these data for grade 8. The data in Figure 2 reveal similar statistics with all groups reporting a significant gain in math achievement. Perhaps an important notation here is that the eighth grade traditional remedial math group had received the special project mathematics in grade 7 and the other two eighth grade remedial sections were in their second year of the special project mathematics.

The Math Anxiety Rating Scale-A (MARS-A) was administered to the study groups the first week of October and again the third week of the following April. The results of these pre- and post-tests are reported in Figure 3 . With the normative mean for the MARS-A for grade 7 being 214, the data revealed that on both tests the advanced math group had low anxiety score means, the regular math group low average, and all three remedial groups had average to above average. With the standard deviation being between 50-60, no significant difference was found for the pre- and post-test differences. Figure 4 reports the same type data for grade 8. The normative mean for grade 8 is 188 and it is of importance to note the increase in math anxiety scores for the advanced math group from pre to post and the decrease in anxiety scores for the traditional remedial group. Also noted is the results that revealed all groups in grade 8 reported mean scores on the post-test of the anxiety scale somewhat above the norm. However, no significant difference was found.

FIGURE 2

SUMMARY OF PRE- AND POST-TEST RESULTS
SRA/GSV MATHEMATICS SCORE MEANS
8TH GRADE GROUPS

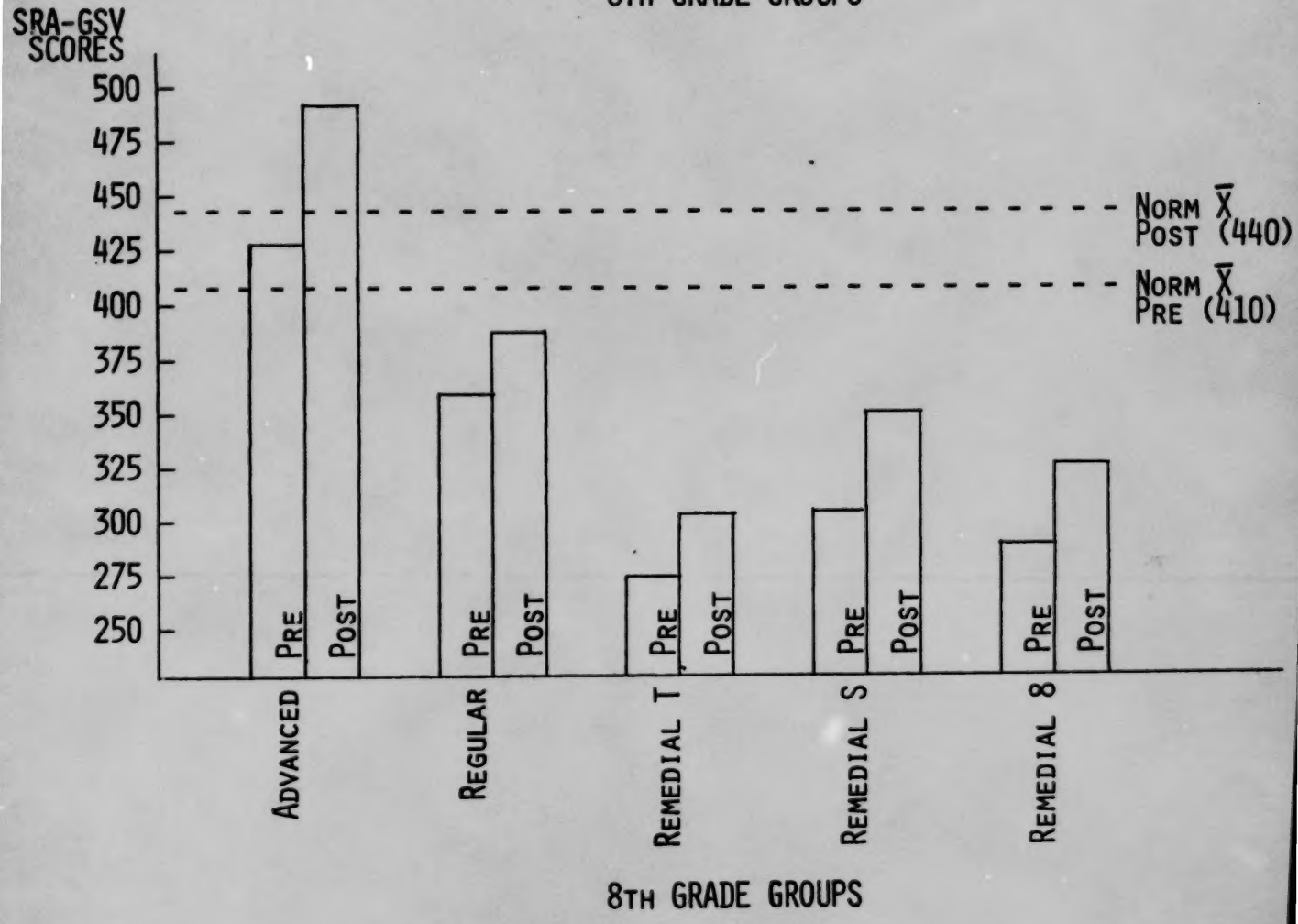


FIGURE 3
SUMMARY OF COMPARISONS WITHIN 7TH GRADE GROUPS
MATH ANXIETY MEAN SCORES FOR PRE-AND
POST-ANALYSIS BY T-TEST

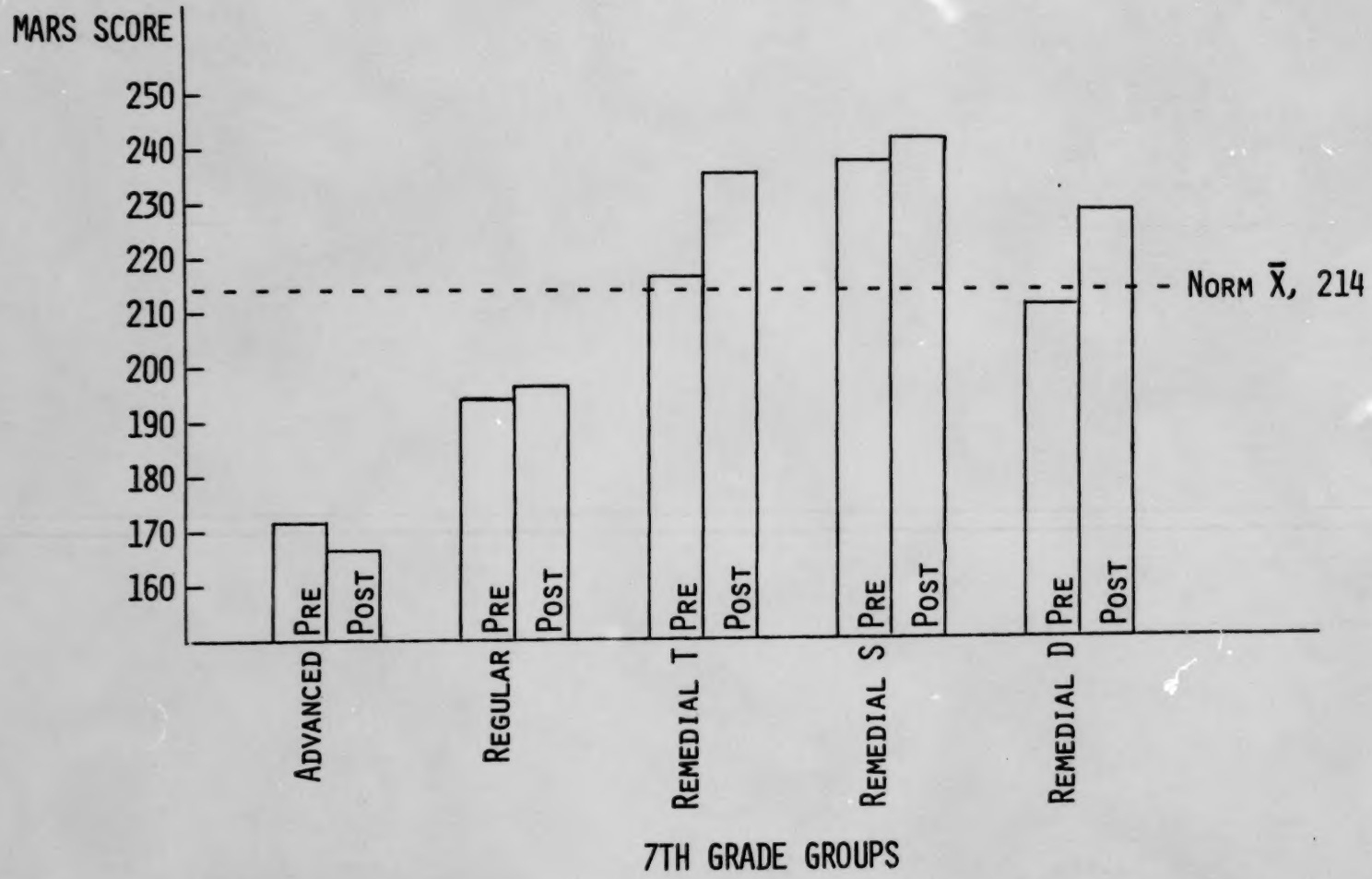
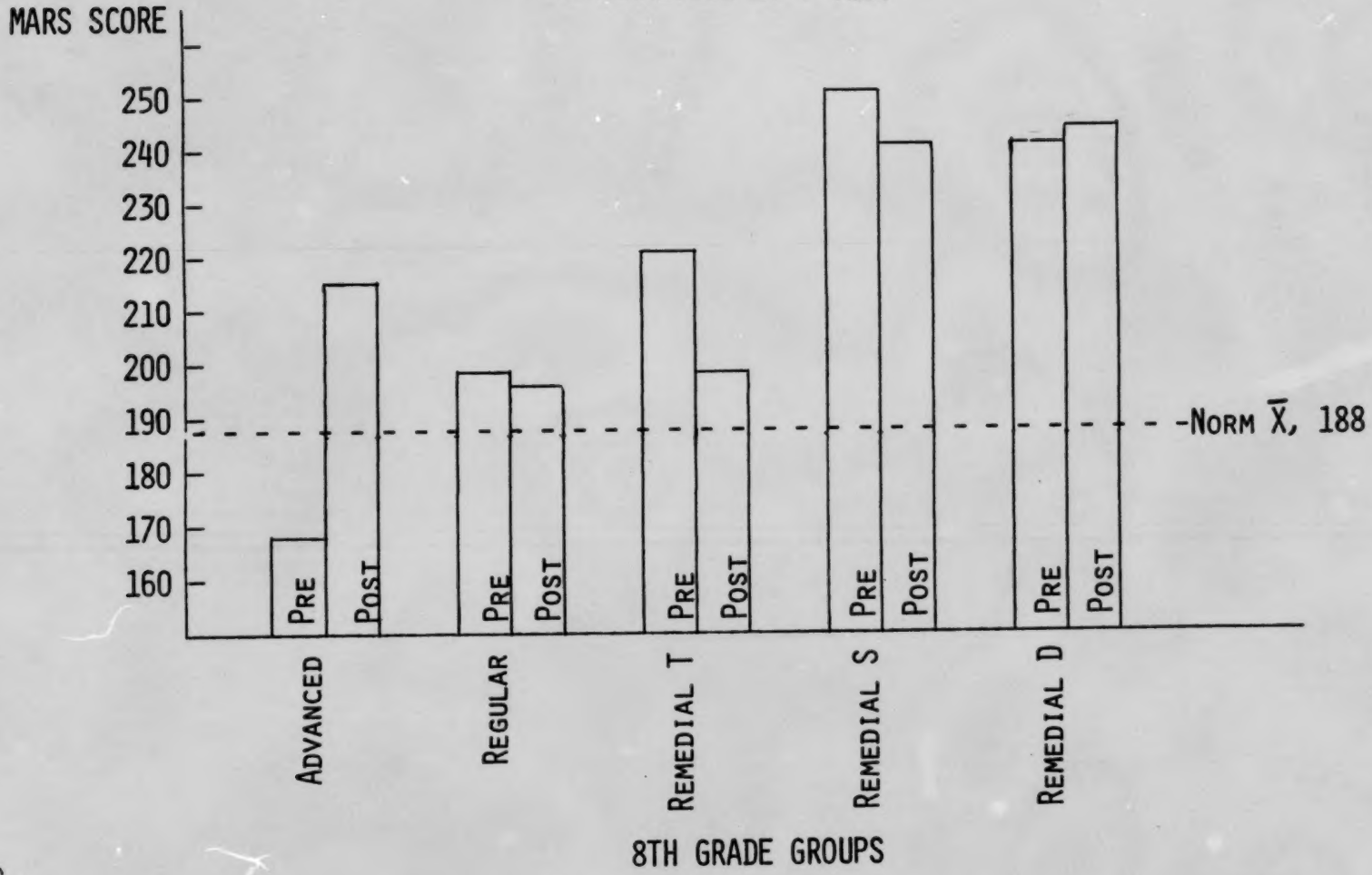


FIGURE 4
SUMMARY OF COMPARISONS WITHIN 7TH GRADE GROUPS
MATH ANXIETY MEAN SCORES FOR PRE- AND
POST-ANALYSIS BY T-TEST



During the administration time of the MARS-A, the students were asked to record a self-appraisal of their math skills in relation to other academic subjects. The provided responses were below, same or above. Figure 5 is a summary of the students responses in percentage of responses for math skills below other academic subjects and above other academic subjects. A point of interest in these results was that for the seventh grade, far more of the advanced math group felt their math skills were below other areas than felt they were above; whereas, in the regular and remedial math groups, many more reported they felt their math skills were equal to or better than their skills in other subject areas. The responses for the eighth grade groups, also reported in Figure 5, revealed a very small percentage of students in the advanced and regular math groups felt their skills were not any better or worse than the other academic areas; by contrast, the remedial group felt quite strongly that their math skills were equal to or better.

With data from the MARS-A and the self-appraisal of math skills, a Pearson product-moment correlation coefficient was computed for the two variables. Figure 6 illustrates these results for both the pretest comparison and the posttest comparison. The data in Figure 6 reveal very small non-significant positive correlation coefficients exist between math anxiety and self-appraisal of math skills for all the presented groups.

In addition to the previous information, the students were asked if they liked math in elementary school with only a yes-no response provided. Figure 7 reports a summary of the percentage of

FIGURE 5
SUMMARY OF SELF-ESTIMATE OF MATH SKILLS
PERCENTAGE ABOVE OR BELOW OTHER ACADEMIC AREAS
7TH AND 8TH GRADE GROUPS

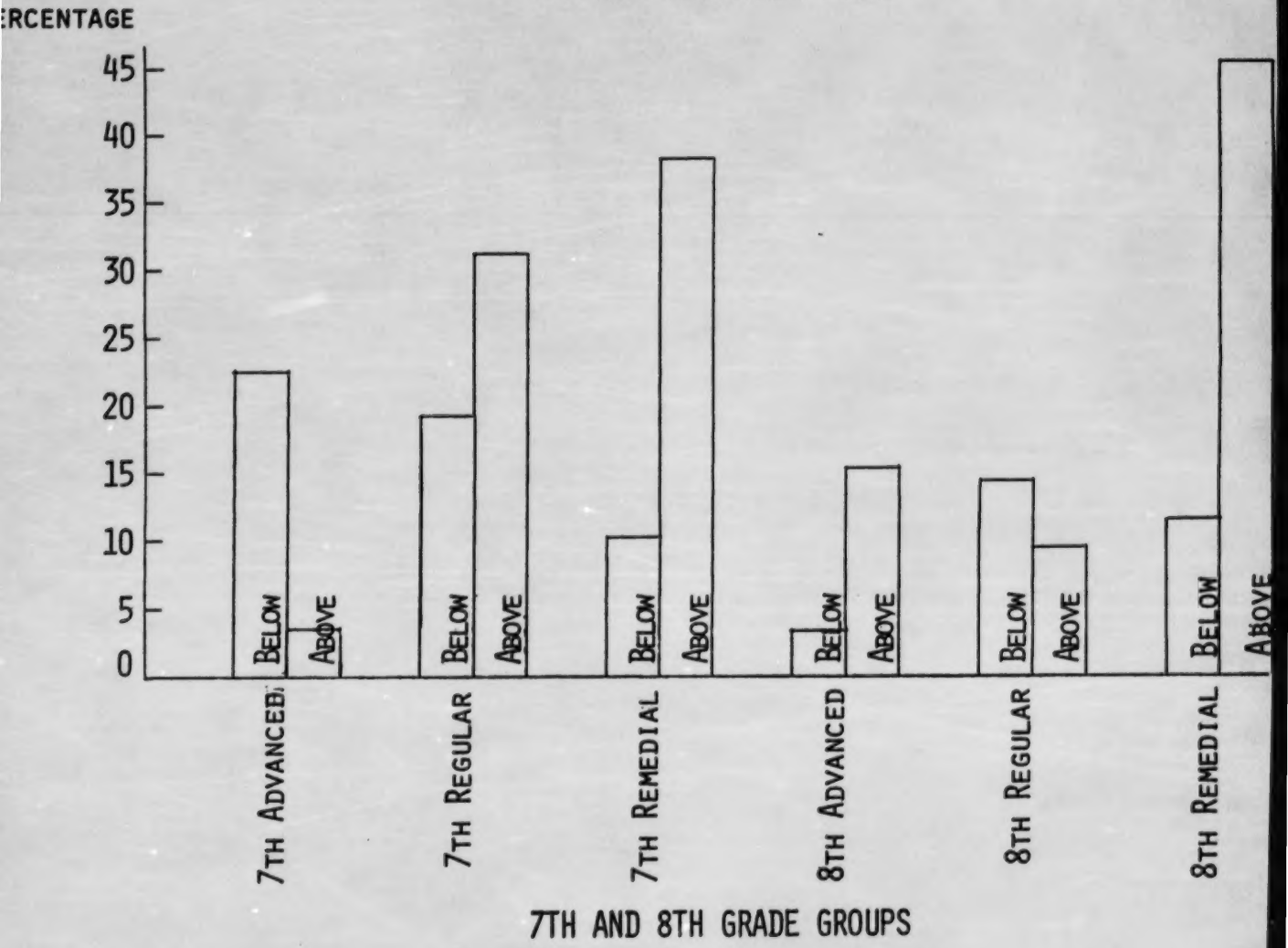


FIGURE 6
SUMMARY OF CORRELATION COEFFICIENTS FOR PRE- AND POST-TESTS
MATH SKILLS AND MATH ANXIETY
7TH AND 8TH GRADE GROUPS

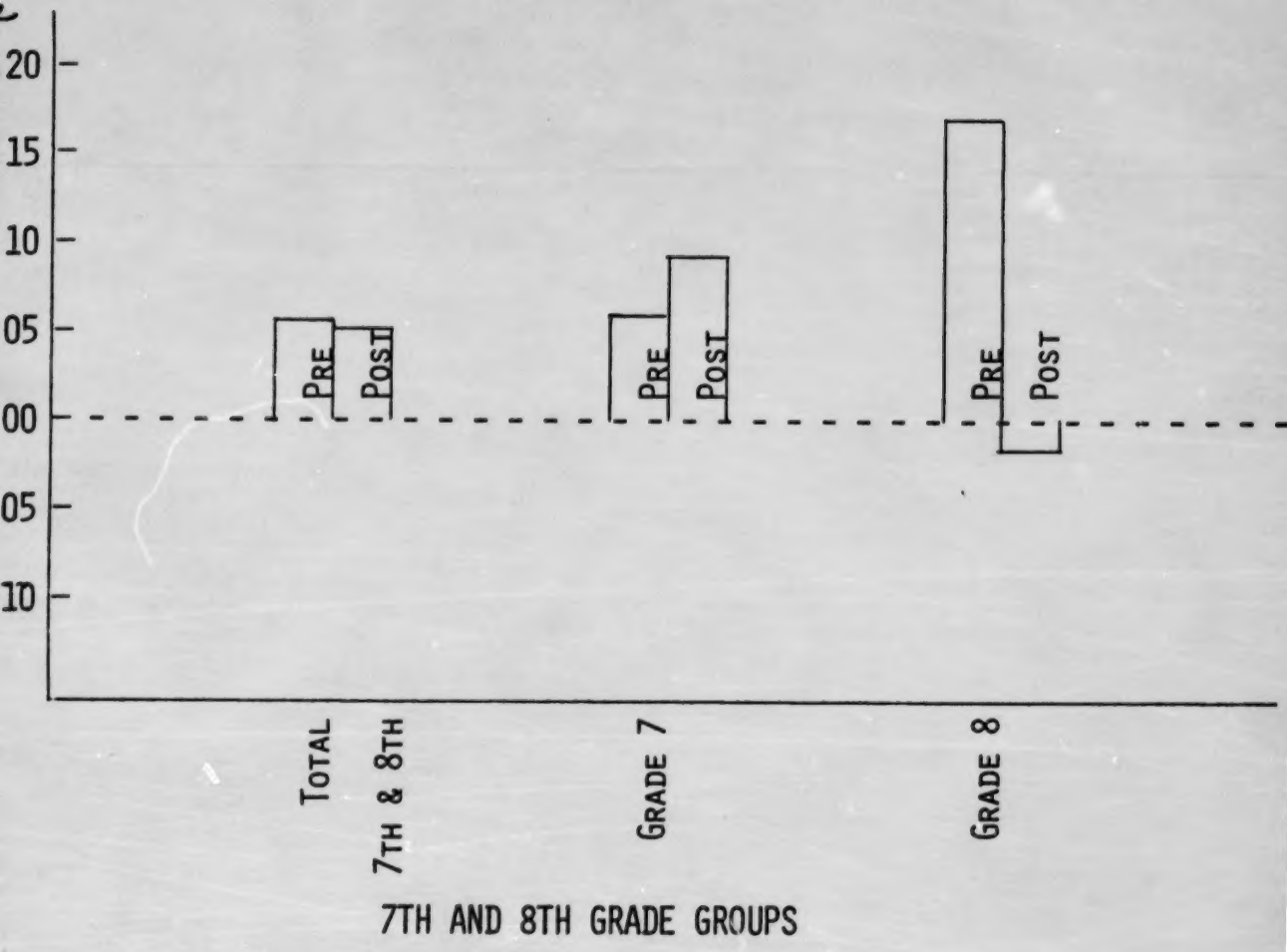
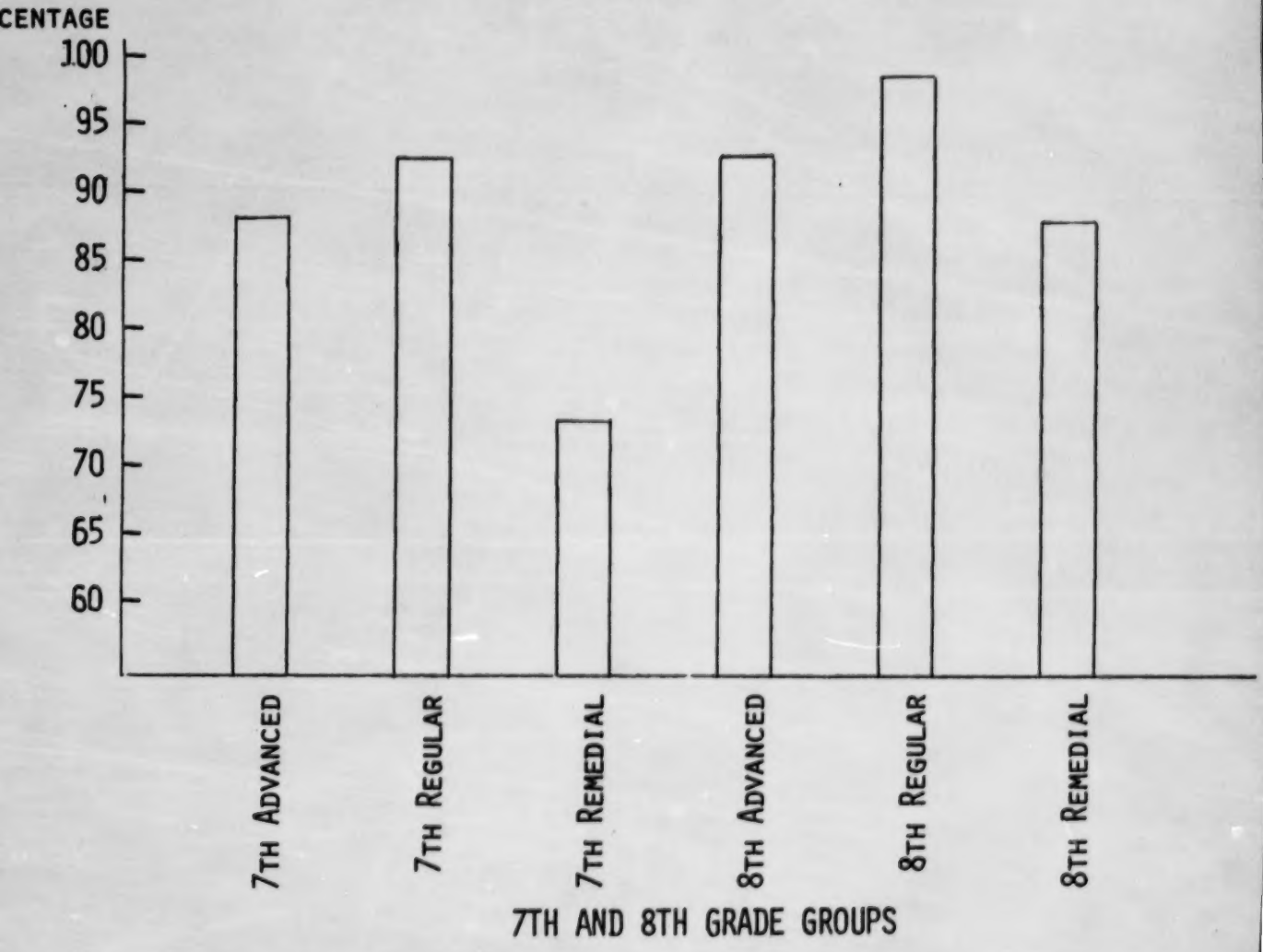


FIGURE 7
SUMMARY OF GROUP PERCENTAGES
LIKED MATH IN ELEMENTARY SCHOOL
7TH AND 8TH GRADE GROUPS

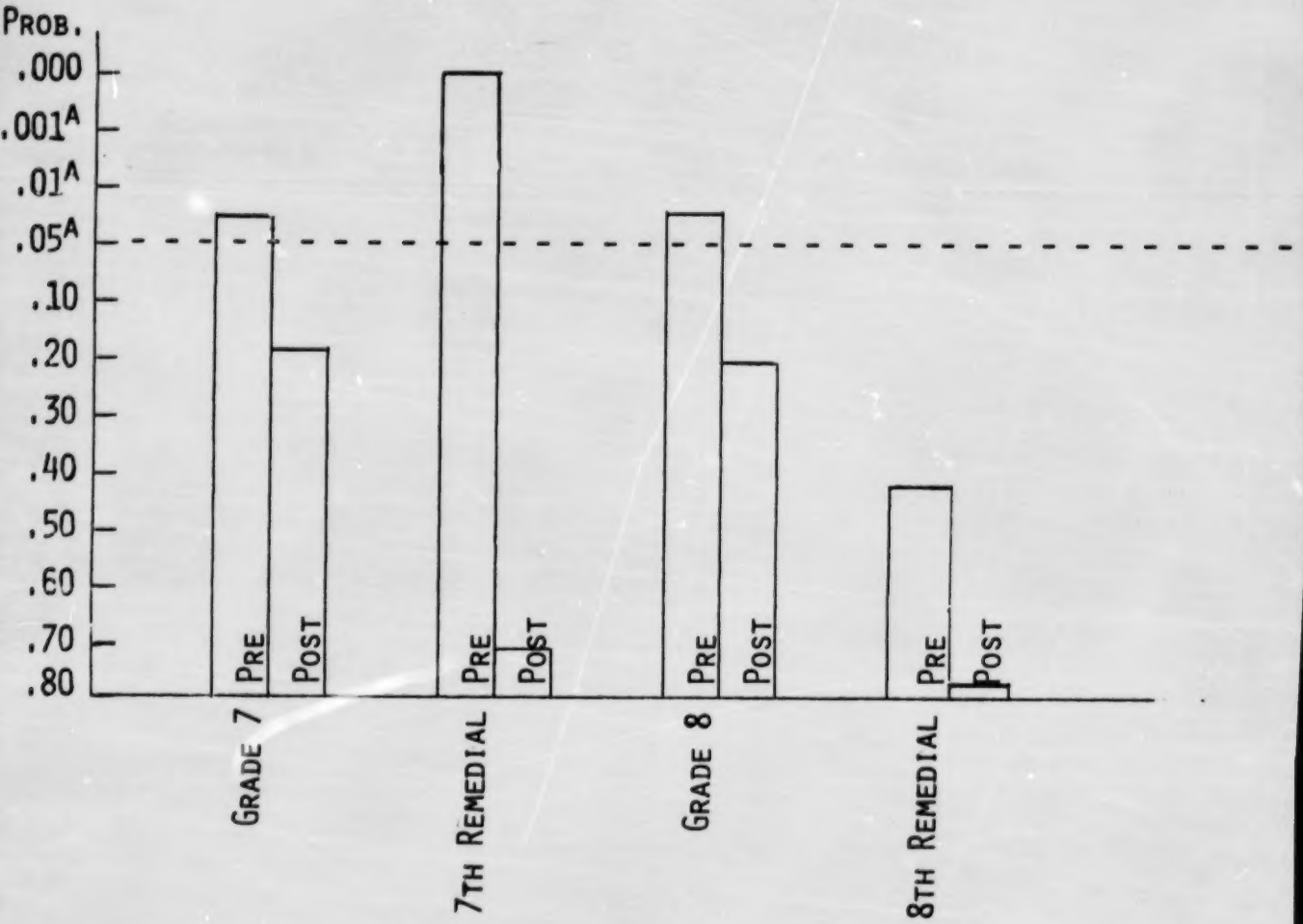


yes responses. The data reveals a very high percent of the seventh and eighth grade students (70-96 percent) who reported they liked math in the elementary grades. This information prompted the investigators to test the question, "Is there a significant difference in math anxiety for students that liked math in elementary school and those that did not?" These results are reported in Figure 8. The data revealed that significant differences did exist in math anxiety score means between likes and not likes for total grade 7 and total grade 8; and, near significance was found for remedial grade 7 for the pretest. However, the posttest results revealed no significant difference existed with a very high probability for the remedial groups that liking math in elementary school or not had little to no impact on the current math anxiety score.

The thrust of this study, however, was to determine the correlation between math anxiety and math achievement. The result of these calculations are reported in Figures 9 and 10 for grades 7 and 8 respectively. The data in Figure 9 reveals that for both the pre- and posttests a significant correlation coefficient was found for all comparisons on both pre and post tests and all were negative correlations. These findings were computed by combining the advanced math and regular math sections with each of the three remedial sections. In each analysis the posttest correlation coefficient was a higher negative than the pretest correlation coefficient. However, when the same analysis was applied to the eighth grade data, Figure 10, very similar results (high negative correlation) were found from the pretest analysis; but, no significant correlations were found for the posttest data.

FIGURE 8

SUMMARY OF PRE- AND POST-TEST ANALYSIS
PROBABILITIES OF DIFFERENCES IN MATH ANXIETY SCORE MEANS BETWEEN
STUDENTS THAT LIKED MATH IN ELEMENTARY SCHOOL AND THOSE THAT DID NOT
FOR SELECTED 7TH AND 8TH GRADE GROUPS



ALack of continuance with equal units intended to enable visual illustration of statistical significant probabilities.

FIGURE 9
SUMMARY OF CORRELATION COEFFICIENTS FOR PRE- AND POST-TESTS
MATH ANXIETY AND MATH ACHIEVEMENT
COMBINED 7TH GRADE GROUPS

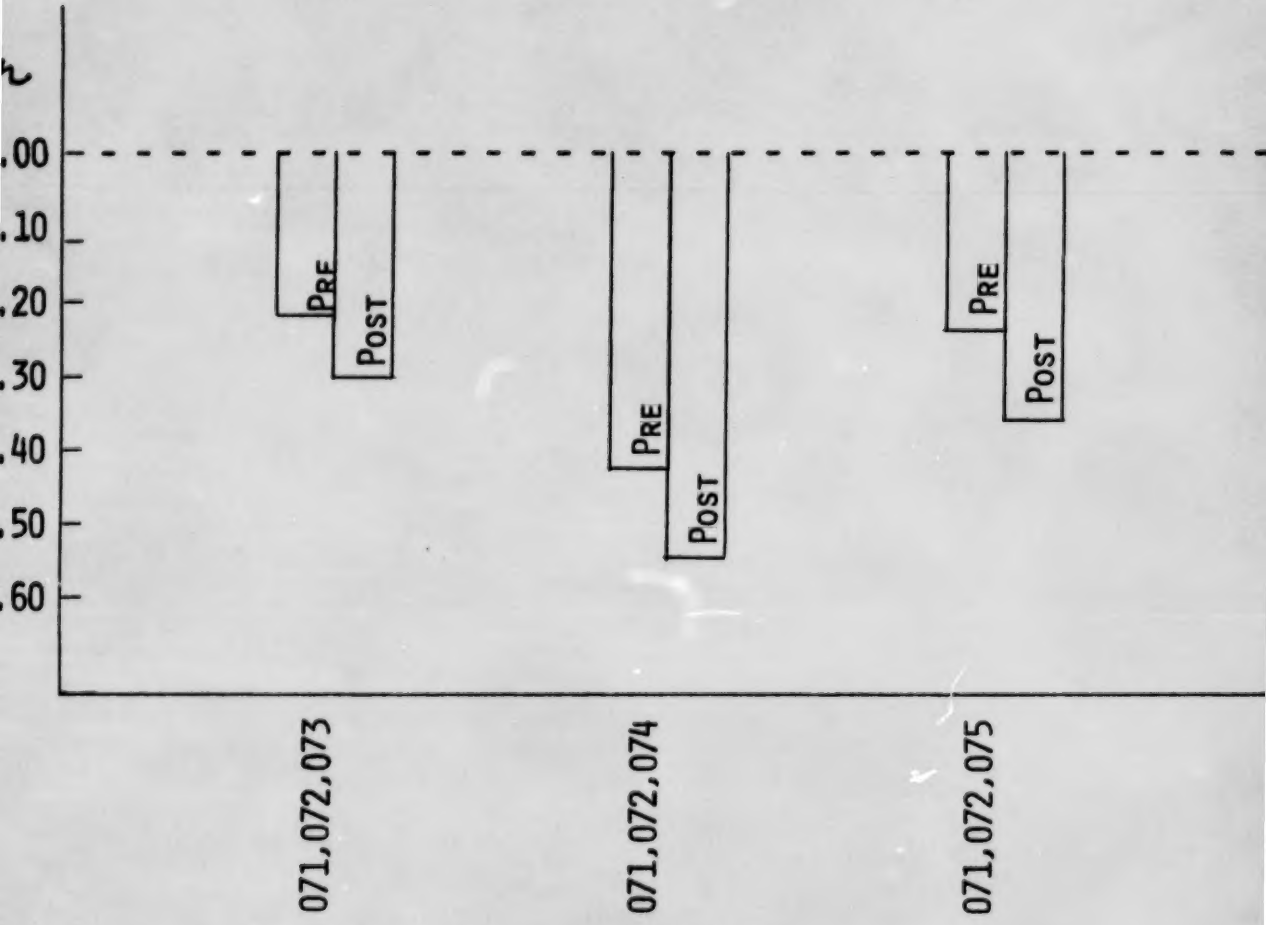
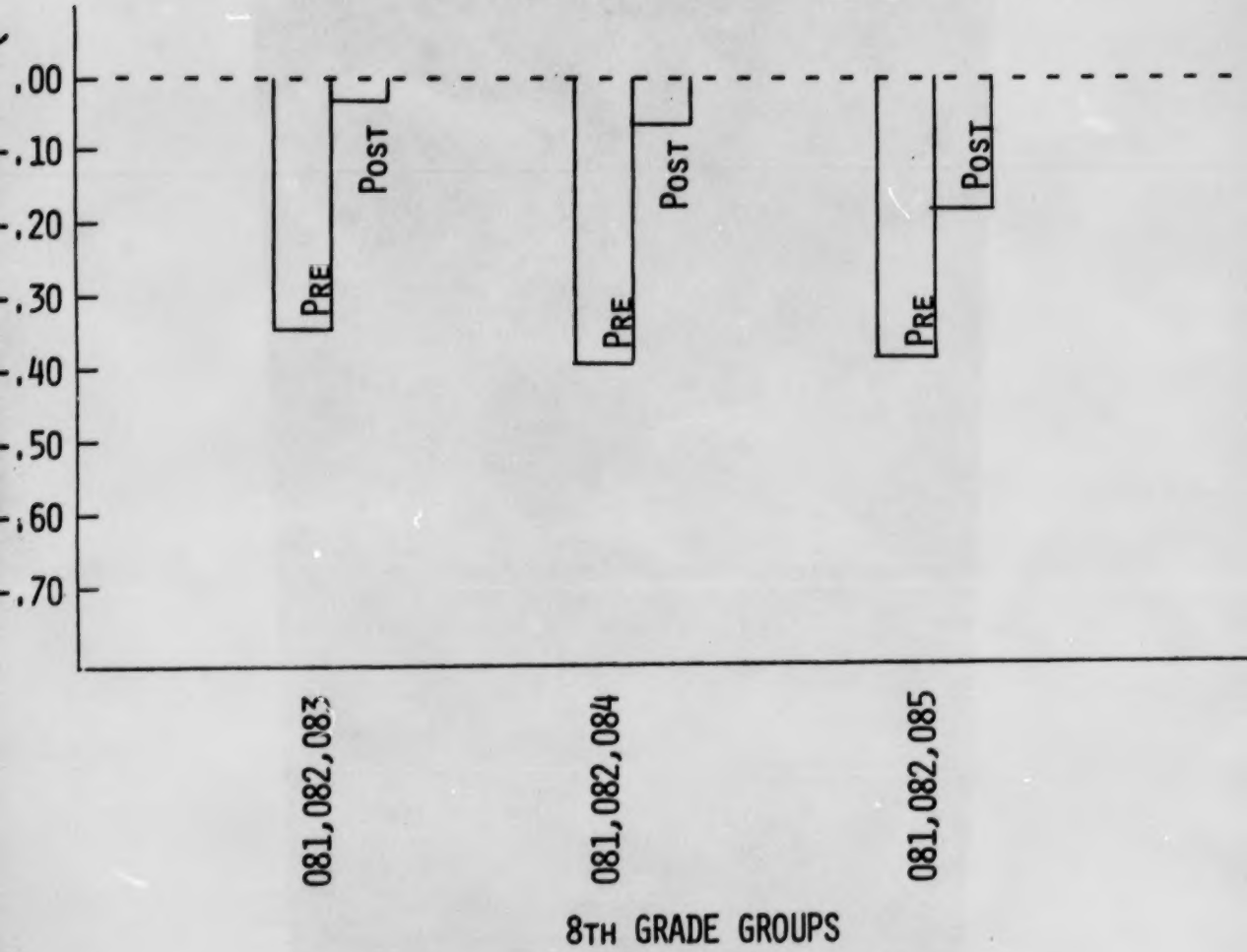


FIGURE 10
SUMMARY OF CORRELATION COEFFICIENTS FOR PRE- AND POST-TESTS
MATH ANXIETY AND MATH ACHIEVEMENT
COMBINED 8TH GRADE GROUPS



Perhaps of primary importance is not the question of statistical differences or significant correlations, but rather the individual students with very high math anxiety. The data presented in Figure 11 reports the percentage of students recording a math anxiety score above the 75th percentile on the pre- and post-tests in the seventh and eighth grades, by math achievement level, according to the norm table. These data reveal that at every level, advanced, regular, and remedial for each grade, some students are very anxious about mathematics. An interesting note is that more of the remedial students in both grades recorded high math anxiety scores on both tests except for the advanced eighth grade math group on the posttest.

Attempting to gain additional insight into the math anxiety problem in the middle grades, the investigators conducted a small non-scientific survey of eleven seventh and/or eighth grade math teachers from four different schools. The questions of the interview centered on the mathematic content of the three levels of instruction, i.e. advanced, regular, and remedial. The insight desired was "What percent of the school year time was spent with instruction on review of content, indepth study of previously taught content, and introduction of new content?" Additionally, the teachers were questioned relative to typical instructional methodology for the three levels and the typical teacher motivation attitude for each of the three levels.

Table II presents a consensus of these responses. The responses revealed that much more new math material is presented in the eighth grade when compared to the seventh grade. This is especially true for the eighth grade advanced group. Additionally, it was noted that

FIGURE 11
SUMMARY OF MARS-A SCORES ABOVE 75TH PERCENTILE
BY GROUP PERCENTAGES FOR PRE- AND POST-TEST
FOR SELECTED 7TH AND 8TH GRADE GROUPS

TABLE II
CONSENSUS OF TEACHER SURVEY ON MATHEMATICS
CONTENT/INSTRUCTION FOR 7TH AND 8TH GRADE

Instruction Level	Content Introduced %			Instructional Methodology	Teacher Attitudes
	Review	Indepth	New		
7th Advanced Math	20	30	50	Traditional	Positive
7th Regular Math	30	50	20	Traditional	Varies
7th Remedial Math	70	30	0	Traditional	Varies to Negative
8th Advanced Math	5	10	85	Traditional	Positive
8th Regular Math	30	30	40	Traditional	Varies
8th Remedial Math	60	30	20	Traditional	Varies to Negative
*7th Project Remedial Math	30	50	20	Developmental	Very Positive
*8th Project Remedial Math	20	60	20	Developmental	Very Positive

*Not Part of Survey but from Project Proposal

the typical instructional methodology did not change from level to level; however, the teacher attitude toward teaching the group did. Adding this information to the previously analyzed data, some very general conclusion type statements will be presented at the end of the presentations.

MATH ANXIETY and COLLEGE FRESHMEN

A professional paper presented as Part III

of a Symposium: Math Anxiety: A Research Report

Presenter

Diane Miller

Annual Conference of the

Mid-South Educational Research Association

Lexington, Kentucky: November, 1981

Math Anxiety and College Freshmen

The purpose of this study was to determine the level of math anxiety experienced by college freshmen in three classes all differing in math content and motivation. The literature, in several studies, reported the following results:

1. Math anxiety exists in our college population.
2. College students in a remedial math class frequently have experienced one or more of the following:
   a. failure in math classes,
   b. avoidance of math classes for years,
   c. a poor attitude toward math.
3. In 1966, 14 percent of freshmen entered college with two years or less of high school math; whereas, in 1976, 25 percent had two years or less.
4. In a first level required math class in college, over 50 percent of the students hold negative attitudes toward math.
5. Math instruction with a supportive atmosphere for learning is effective in decreasing math anxiety.

This investigation focused on the influence selected variables had on the students' attitude toward mathematics. The Mathematics Anxiety Rating Scale (MARS, 1979), developed and validated by Richard Suinn, was the basic instrument used in data collection.

The participants in the study were randomly selected from the students enrolled in Foundation Mathematics 10013X (N = 58), Basic Mathematics 10103 (N = 35), and Elementary Education 10003 (N = 44).

Foundation Mathematics is a Developmental Mathematics class offered in a special services program at ASU. Students enter the class for one of three reasons: (1) ACT probability score for mathematics is less than or equal to 38; (2) referred to the class by a counselor, advisor, or someone else; and (3) entered the class voluntarily. Basic Mathematics is the first general mathematics course for which students can earn college credit. Elementary Education is a general education course for freshmen considering elementary education as a major.

The MARS was completed anonymously. Participants were asked to complete a short, investigator-developed questionnaire to provide information for subgrouping. These responses enabled the investigators to compute indepth comparisons regarding the following questions:

1. Did having Algebra I in high school "influence" the degree of math anxiety experienced by the participants?
2. Did the participants "like math" at various levels of school?
3. Did the participants perceive their math skills less than, equal to, or better than their skills in other academic areas?
4. Did the participants' major have any bearing on the degree of math anxiety exhibited?

Table 1 presents the specific identifying information on each of the groups and subgroups. The norm mean score for the adult form of the MARS is 215; and, as the data in Table 1 illustrates, the mean score for the total study is 232. The mean score for each of the three series is above the norm mean of 215. Of significant importance to the investigators was that the Developmental Math students had the lowest

TABLE 1
IDENTIFYING INFORMATION

SERIES	GROUP	NUMBER
110	PASS STUDENTS	58
220	BASIC MATHEMATICS	35
330	FOUNDATIONS OF EDUCATION	44

GROUP STATISTICS

ROUP	MEAN	MEDIAN	STANDARD DEVIATION
ORM	215	215	65
OTAL GROUP (FILE ONE)	232	225	68
ERIES 110	229	222	66
220	240	240	74
330	229	219	65

TABLE 1 (CONTINUED)
GROUP STATISTICS

SUBGROUP	NUMBER	MEAN	STANDARD DEVIATION
COLLEGE MAJOR			
NON-ELEMENTARY	82	230	68
ELEMENTARY	55	235	67
HIGH SCHOOL MATH			
WITH ALGEBRA I	110	228	69
WITHOUT ALBEGRA I	27	245	60
MATH SKILLS			
LESS THAN OTHER	77	248	67
EQUAL TO OTHER	47	218	65
MORE THAN OTHER	13	185	47
LIKE MATH IN ELEMENTARY SCHOOL			
YES	105	220	63
NO	32	265	69
LIKE MATH IN JUNIOR H.S.			
YES	80	214	61
NO	57	256	69
LIKE MATH IN HIGH SCHOOL			
YES	60	207	62
NO	77	251	89
LIKE MATH IN COLLEGE			
YES	71	208	63
NO	66	254	65

MARS mean. The information in Table 1 reveals that the only subgroups with mean MARS scores below the norm mean were those students who perceived their math skills to be better than their skills in other academic areas and those students who said they liked math in junior high, high school and college. Of these subgroupings, the only appreciable difference in means is found with those students who perceived their math skills as good.

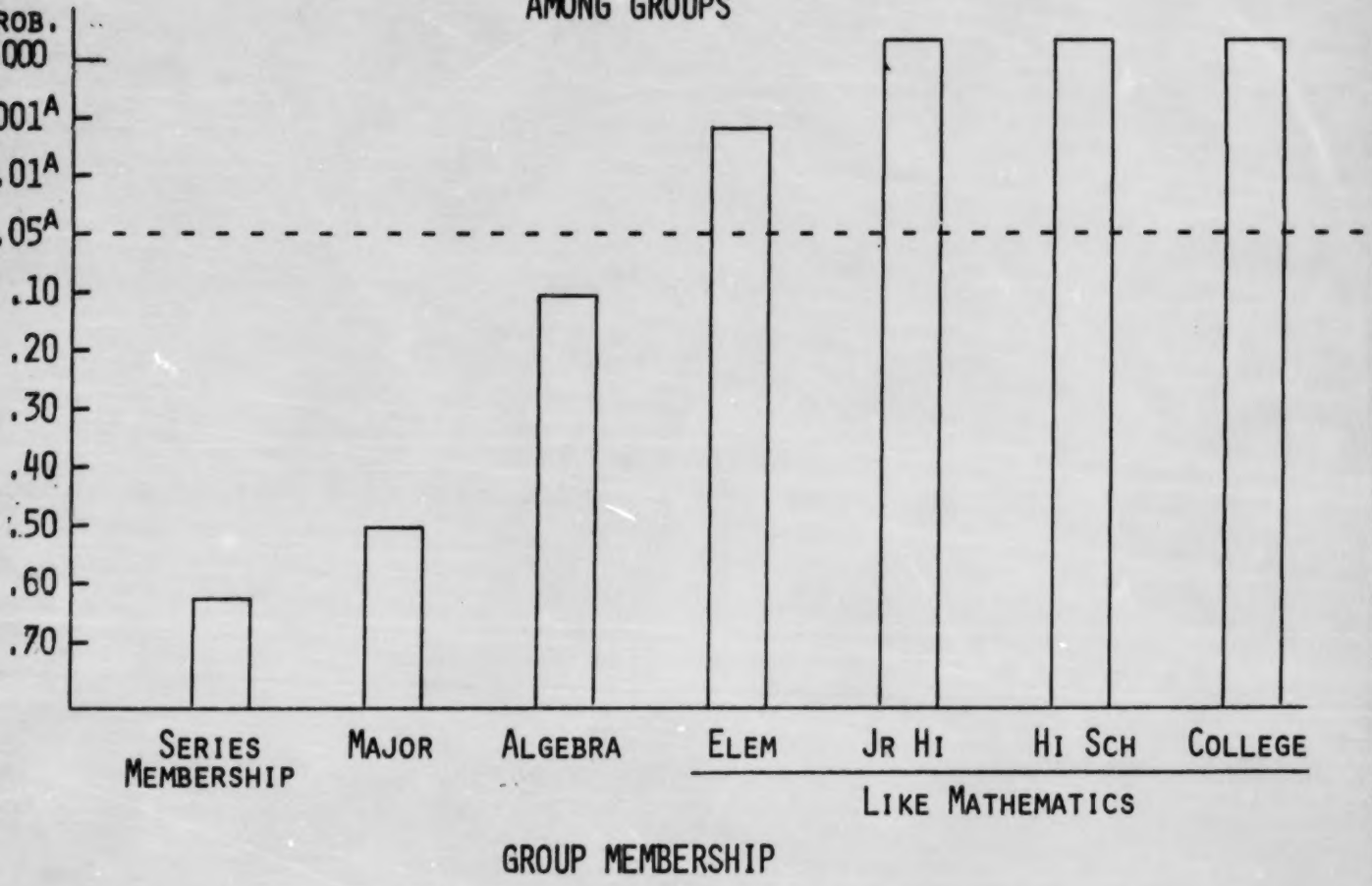
Figure 1 presents the summary of the differences in math anxiety score means for the several groups considered. The .05 level of confidence was considered as significant. The data revealed no significant differences for the groups of series membership, college major, or having had Algebra I in high school. The data did reveal highly significant differences in math anxiety score means for the groups based on their like or dislike of math at various levels of school.

The data in Figure 2 presents the summary of the correlation coefficients between the math anxiety scores and the participants' self-appraisal of math skills for selected groups. The data illustrates that a highly significant negative correlation was found for each of the groups tested except the Developmental Math students.

The data in Figure 3 presents the summary of the comparison within series membership and liking math at various levels of school. The comparisons employed the chi-square technique for analysis between the participants' self-appraisal of math skills and liking math at various levels of school. The analysis of data reveals a highly significant association existing between participants' self-appraisal of skills and liking math at various levels of school. Of particular interest to the investigators was the significance of the Developmental

FIGURE 1

SIGNIFICANT DIFFERENCES IN MATH ANXIETY SCORES AMONG GROUPS



[A]Lack of continuance with equal units intended to enable visual illustration of statistical significant probabilities.

FIGURE 2
CORRELATION: MATH ANXIETY SCORE WITH SELF-ESTIMATE OF SKILLS

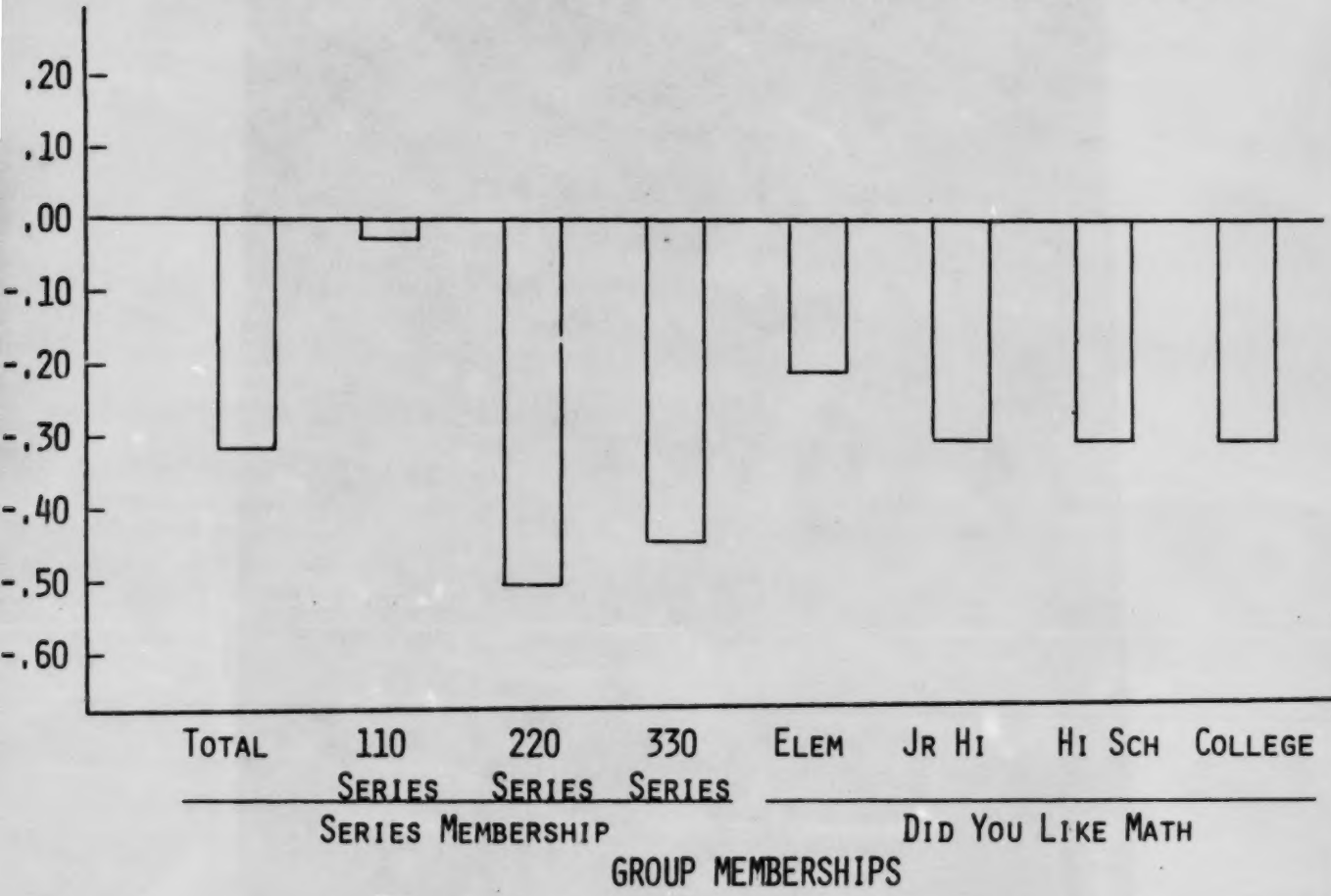
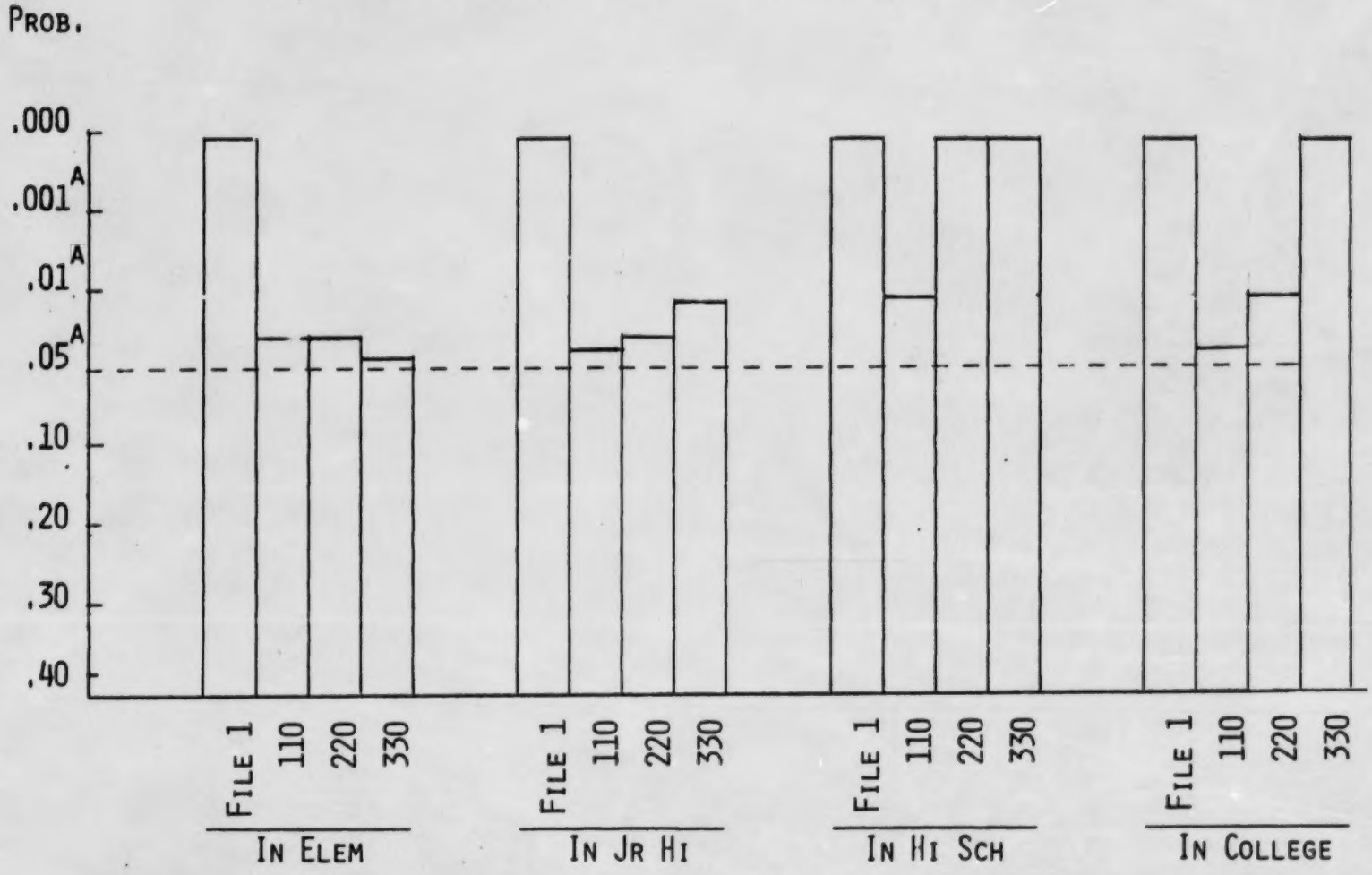


FIGURE 3
SUMMARY OF COMPARISONS WITHIN SERIES
MATH SKILLS WITH LIKE MATH: ANALYSIS BY CHI-SQUARE



ALack of continuance with equal units intended to enable visual illustration of statistical significant probabilities.

Math students' association as usually being less than or equal to the other series within each subgroup.

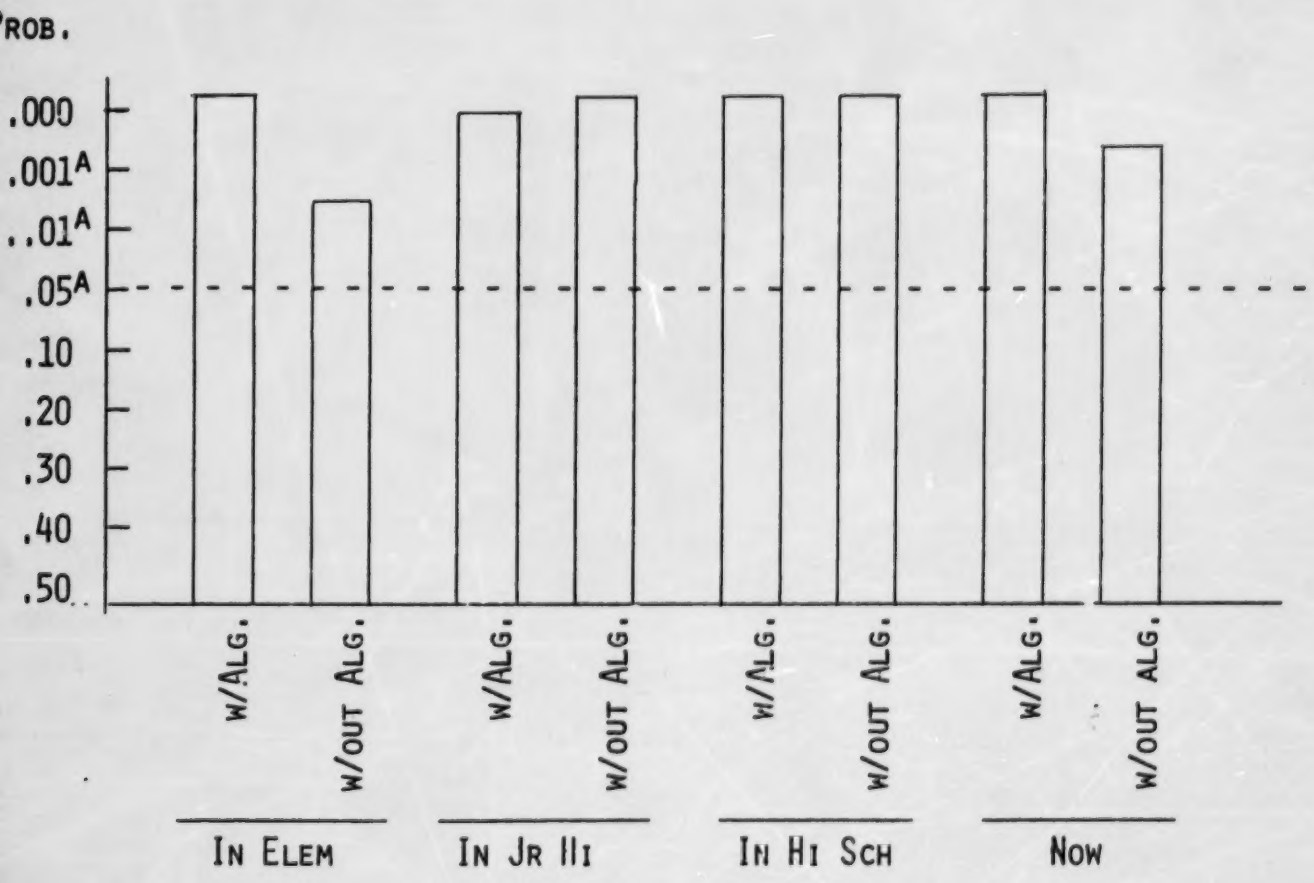
Figure 4 presents similar comparisons for the subgroups of having had Algebra I in high school and whether or not the participant liked math in elementary, junior high, high school and now. The data illustrates that a highly significant association, by chi-square analysis, exists between liking math and having had Algebra I in high school. Only in junior high was the association more significant for those students who had not had Algebra I.

Of particular interest to the investigators was the percentage of participants that recorded a math anxiety score at or above the 75th percentile. Figure 5 reflects these percentages for the series membership. With the exception of the Elementary Education students, 50 percent or more of the students recorded scores at this level.

Perhaps this finding is the most important disclosure of the study. Students falling in this percentile range generally limit themselves to 25 percent of the careers available in today's society by selecting non-mathematical college majors. However, educators are showing that a supportive atmosphere for learning math in the form of special math anxiety reduction programs has a positive effect on a person's mathematical academic performance. The findings of this study were combined with findings of the other two studies, and general conclusion type statements are presented in session five of this symposium.

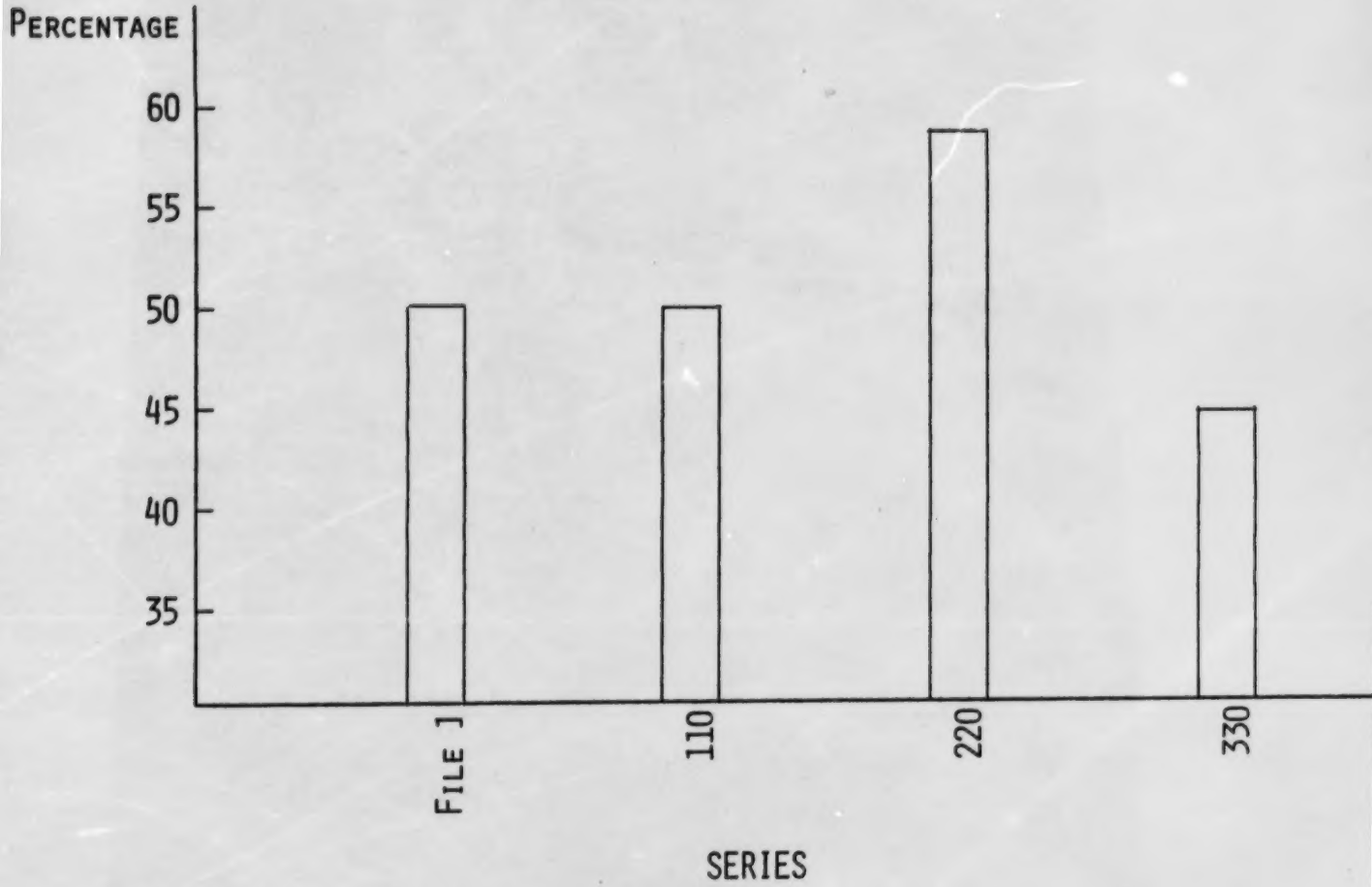
FIGURE 4

SUMMARY OF COMPARISONS FOR STUDENTS HAVING HAD ALGEBRA I MATH SKILLS WITH LIKE MATH: ANALYSIS BY CHI-SQUARE



A Lack of continuance with equal units intended to enable visual illustratio of statistical significant probabilities.

FIGURE 5
PERCENTAGES OF MARS SCORES ABOVE
75TH PERCENTILE: BY SERIES MEMBERSHIP



MATH ANXIETY and ELEMENTARY TEACHERS

A professional paper presented as Part IV

of a Symposium: Math Anxiety: A Research Report

Presenter

Don Wright

Annual Conference of the

Mid-South Educational Research Association

Lexington, Kentucky: November, 1981

Math Anxiety and Elementary Teachers

This study was concerned with the level of math anxiety experienced by teachers and student-teachers trained in elementary education. Several articles in leading education journals have indicated that math anxiety may be initiated in the elementary schools by elementary teachers. The intent of this study was to investigate selected variables surrounding the "elementary teacher's" attitude toward mathematics. The Math Anxiety Rating Scale (MARS, 1979) was the basic instrument used in data collection.

The participants consisted of three distinct teacher education groups. One group was all the college seniors with majors in elementary education just prior to student teaching, fall 1980, and a second group was all the college seniors with majors in elementary education just after student teaching, fall 1980. A third group consisted of a total staff of practicing elementary teachers in a public school system grades K-4. During the administration of the MARS, which was completed totally anonymous, the participants were asked to complete a short investigator developed questionnaire to provide information for additional grouping and subgrouping. These responses enabled the investigators to compute indepth comparisons regarding the following questions: (1) Did the participants "like math" at various levels of school? (2) Did the participants perceive their math skills less than, equal to, or better than their skills in other academic areas? (3) Did the participants like to or would they like to teach math? Additionally, the participants were asked to identify their specific

college major, the number of math classes taken in college, the number of years of teaching experience, and the number of graduate hours they had earned.

Table 1 presents the specific identifying information on each of the groups and subgroups. The norm mean score for the adult form of the MARS is 215 and, as the data in Table 1 illustrates, the mean score for this total study is 207. The information in Table 1 reveals that the groups and subgroups with mean MARS scores above the norm mean were: the pre student-teaching group; the elementary/early childhood major; participants with exactly three college math classes; participants who viewed their skills in math as less than or equal to their skills in other areas; the participants that did not or would not like to teach math; and the participants that did not like math in elementary, junior high, high school, or college. Although some of these differences were minimal, other variances were quite large.

Figure 1 presents the summary of the differences in math anxiety score means for the several groups considered. The .05 level of confidence was considered as significant. The data revealed no significant differences for the groups of series membership, teaching majors, graduate level for inservice teachers, or teaching experiences. However, the data did reveal highly significant differences in math anxiety score means for the groups involving different number of college math classes, whether they liked math in elementary school, junior high school, etc., and if they liked or would not like to teach math.

TABLE 1
IDENTIFYING INFORMATION

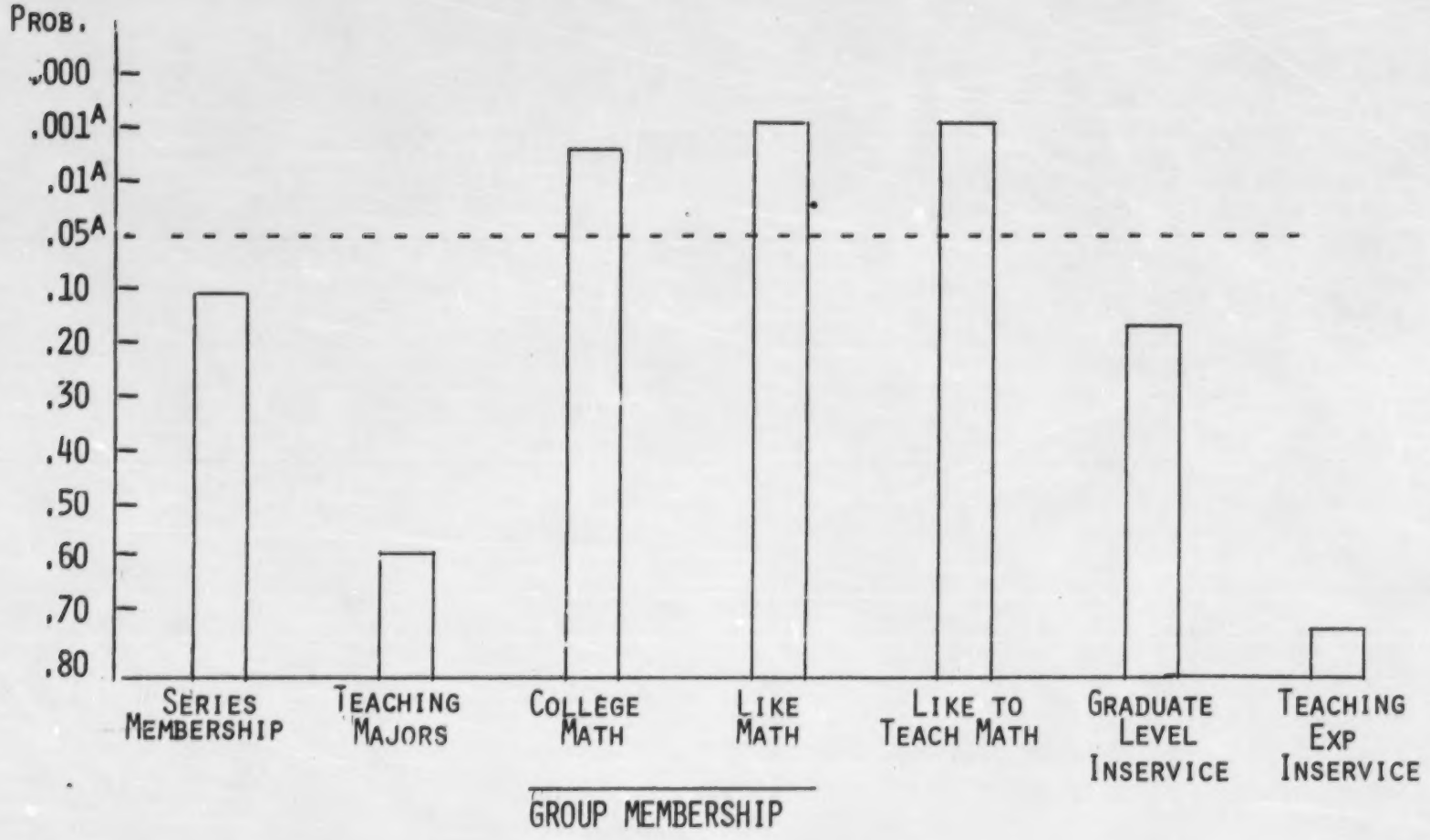
Series	Group	Number
110	Pre-Student Teaching	72
220	Post-Student Teaching	55
330	Inservice Teachers	93
Total		220

Group Statistics

Group	Mean	Median	Standard Deviation
Norm	215	215	65
Total Group (File 2)	207	197	71
Series 110	222	210	69
220	200	180	75
330	199	186	68

SUB-GROUP	GROUP STATISTICS NUMBER	MEAN	STANDARD DEVIATION
College Major			
Regular Elementary	133	202	66
Elementary/Early Childhood	47	218	58
Elementary/Special Education	36	213	63
No. College Math Classes			
Less than three	65	212	69
Exactly three	118	215	71
More than three	37	169	53
Math Skills			
Less than other	95	248	69
Equal to others	97	218	61
More than other	28	186	59
Like to Teach Math			
Yes	132	186	54
No	88	238	63
Like Math in Elementary School			
Yes	170	194	63
No	50	250	69
Like Math in Junior High School			
Yes	141	191	66
No	79	235	72
Like Math in High School			
Yes	117	183	68
No	103	233	63
Like Math in College			
Yes	120	176	61
No	100	244	67

FIGURE 1
SIGNIFICANT DIFFERENCES IN MATH ANXIETY SCORES
AMONG GROUPS



ALack of Continuance with equal units intended to enable visual illustration of statistical significant probabilities.

The data in Figure 2 presents the summary of the correlation coefficients between the math anxiety scores and the participants self-appraisal of math skills for selected groups. The data illustrates that a highly significant negative correlation was found for each of the groups tested with the higher coefficients representing the post-student teaching group, the elementary/special education majors, and for participants that had taken more than three college math classes.

The data in Figure 3 presents the summary of the comparisons within the two groups of series membership and the number of college math classes. The comparison, computed for each of the subgroups, are between liking to teach math and liking math in elementary school; and liking to teach math and liking math in college. The data illustrates that a highly significant association, by chi-square analysis, exists between liking to teach math and liking math in college for all subgroups. In turn, however, there appears to be an association, although not significant for each subgroup, between liking math in elementary school and liking to teach math.

Figure 4 presents similar comparisons for the subgroups of series membership, college major, and number of college math classes. Again, the comparisons employed the chi-square technique for analysis between the participants self-appraisal of math skills and liking to teach math. The analyses of data reveals that no significant association exists between the variables for the following subgroups; the practicing teachers (330 series); the elementary/early childhood majors; participants with less than three college math classes; and participants with more than three college math classes. However, the anlayses of data for the other subgroups, e.g., both groups of

FIGURE 2

CORRELATION: MATH ANXIETY SCORE WITH SELF ESTIMATE OF SKILLS

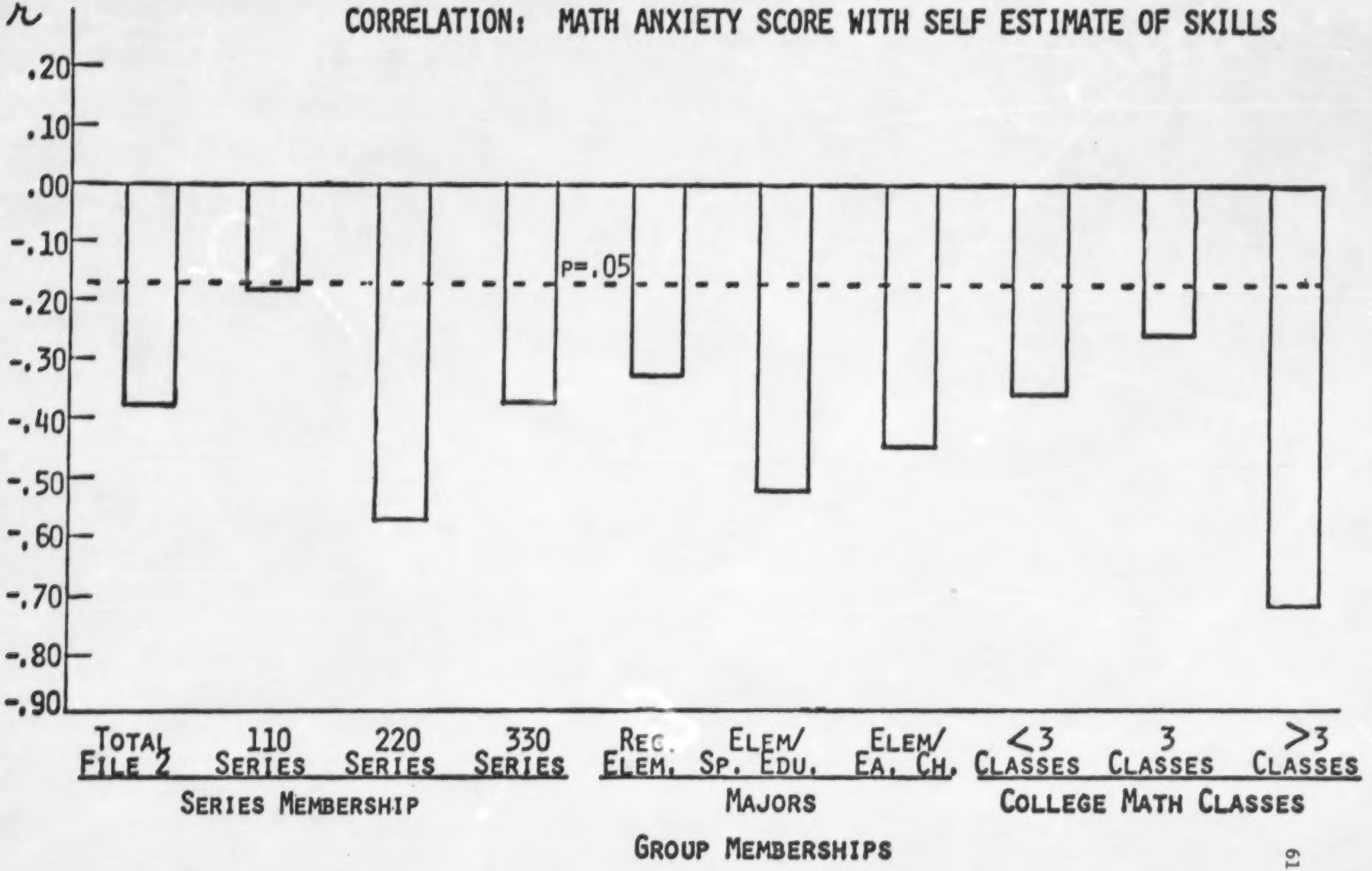
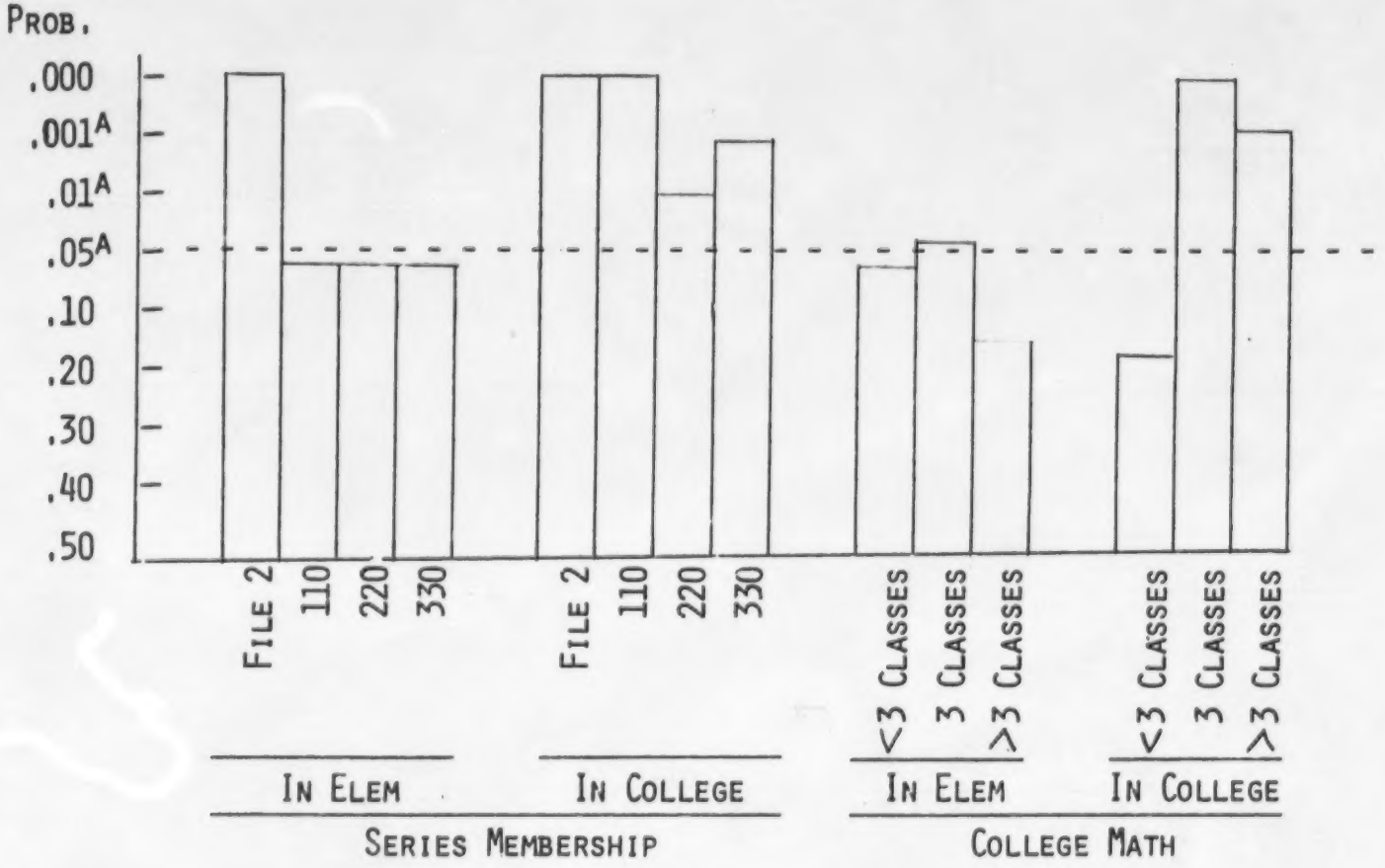
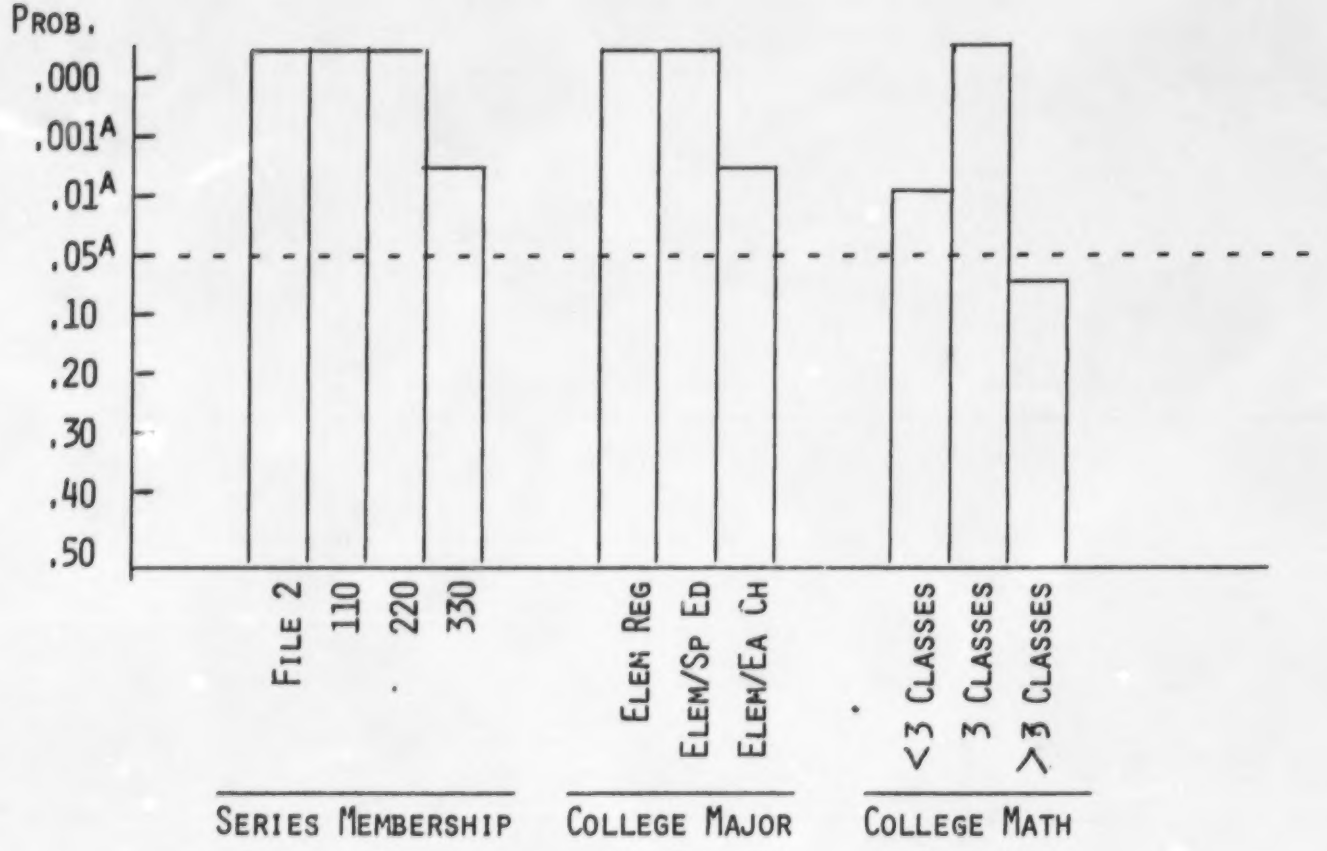


FIGURE 3
SUMMARY OF COMPARISONS WITHIN GROUPS
LIKE TO TEACH MATH WITH LIKE MATH IN ELEMENTARY SCHOOL
AND IN COLLEGE: ANALYSIS BY CHI-SQUARE



A Lack of continuance with equal units intended to enable visual illustration of statistical significant probabilities.

FIGURE 4
SUMMARY OF COMPARISONS AMONG GROUPS
MATH SKILLS WITH LIKE TO TEACH MATH:
ANALYSIS BY CHI-SQUARE



A Lack of continuance with equal units intended to enable visual illustration of statistical significant probabilities.

student teachers, the regular elementary major, the elementary/special education major, and participants with exactly three college math classes, did reveal a highly significant association existing between participants self-appraisal of skills and liking to teach mathematics.

The investigators examined the association, via chi-square analysis, between the participants self-appraisal of math skills and if they liked math at various levels of school. These analyses are presented for the subgroups of series membership, college majors, and college math classes completed by each of the levels of school.

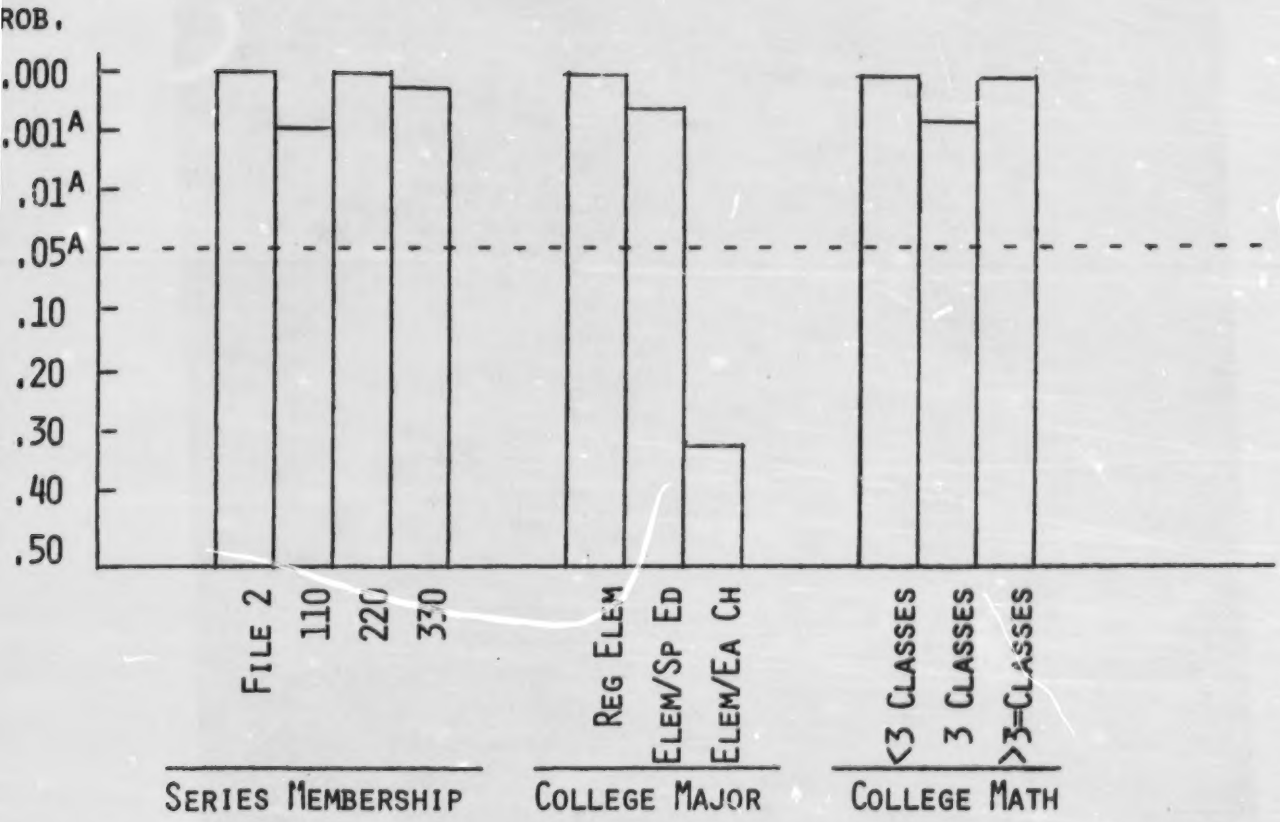
Figure 5 presents the summary analyses for the subgroups for math skills and liking math in elementary school. The data reveal that with the exception of the elementary/early childhood major all subgroups reported a highly significant association exists between the two variables.

Figure 6 presents similar data for the subgroups at the junior high level. This time the elementary/early childhood subgroup was joined by the elementary/special education subgroup to report a non-significant association; yet, all other subgroups reflect a strong significant association between the two variables.

Figure 7 presents the data for the subgroups for the high school level and Figure 8 for the college level, all subgroups report a highly significant association between the two variables at both these levels.

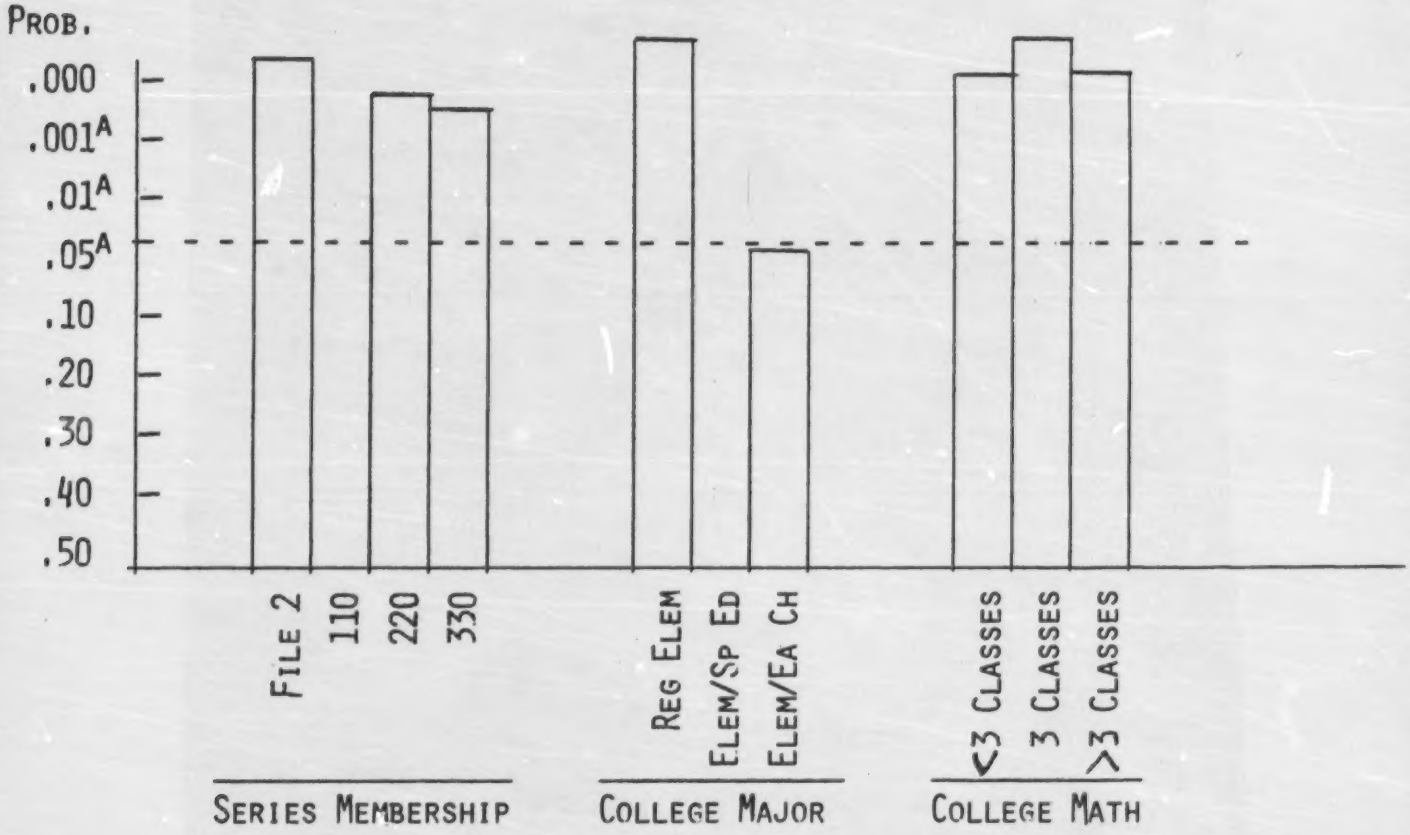
Of particular interest to the investigators was the percentage of participants that recorded a math anxiety score at or above the 75th percentile. Figure 9 reflects these percentages for the series

FIGURE 5
SUMMARY OF COMPARISONS WITHIN GROUPS
MATH SKILLS WITH LIKE MATH IN ELEMENTARY SCHOOL:
ANALYSIS BY CHI-SQUARE



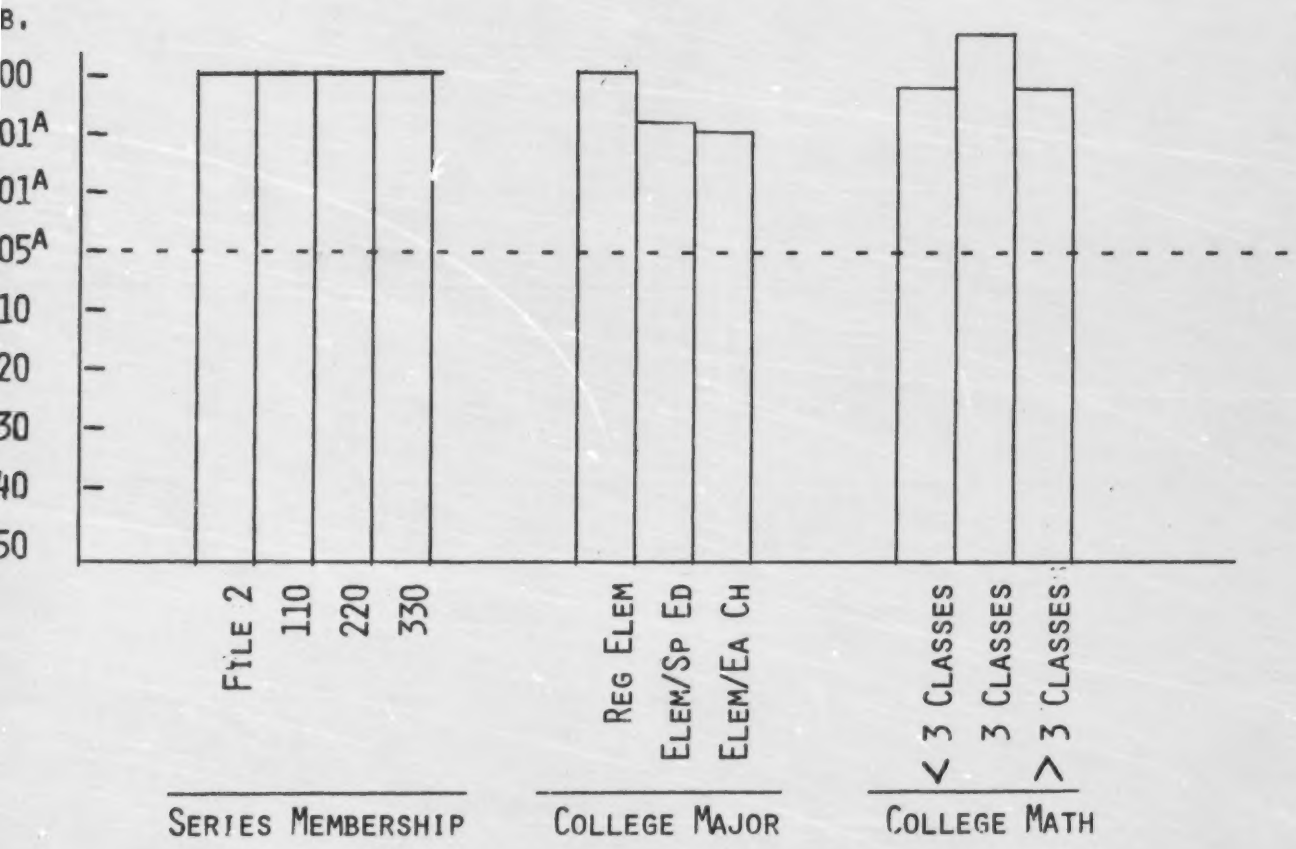
[A] Lack of continuance with equal units intended to enable visual illustration of statistical significant probabilities.

FIGURE 6
SUMMARY OF COMPARISONS WITHIN GROUPS
MATH SKILLS WITH LIKE MATH IN JUNIOR HIGH SCHOOL:
ANALYSIS BY CHI-SQUARE



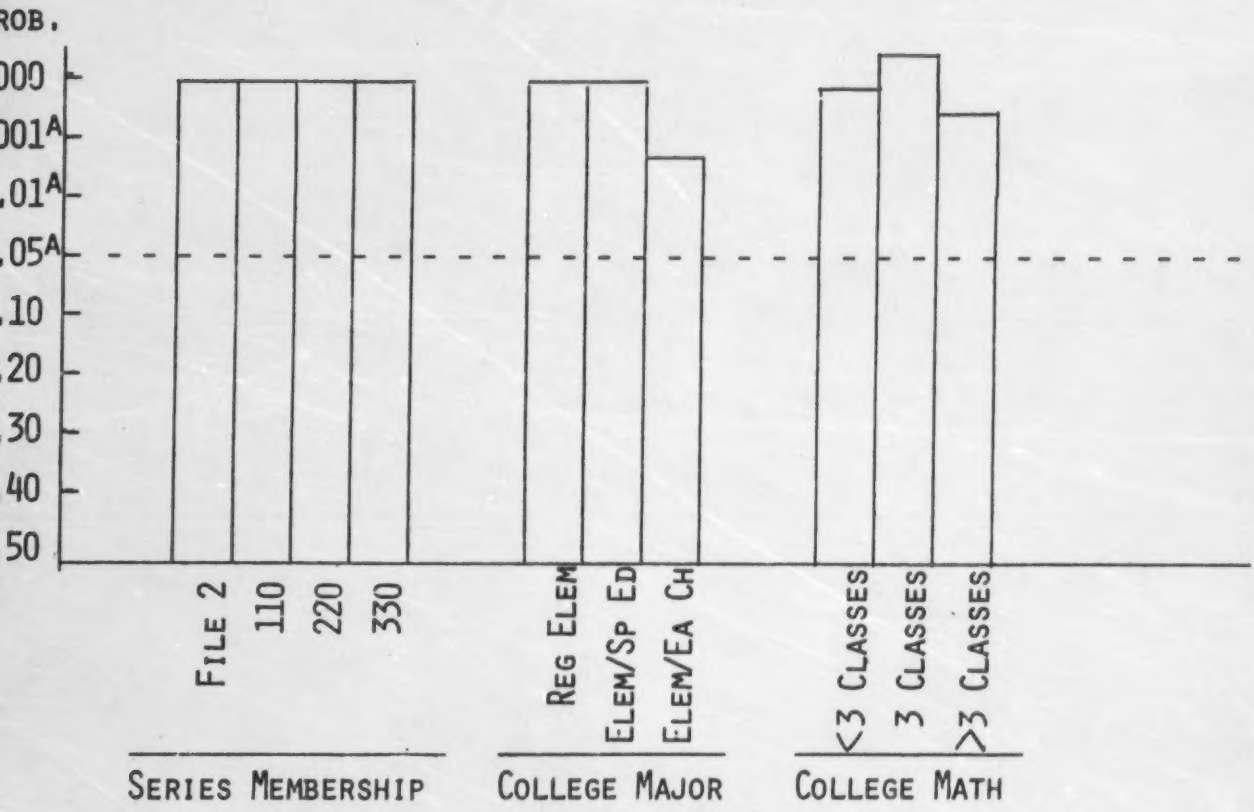
ALack of continuance with equal units intended to enable visual illustration of statistical significant probabilities.

FIGURE 7
SUMMARY OF COMPARISONS WITHIN GROUPS
MATH SKILLS WITH LIKE MATH IN HIGH SCHOOL:
ANALYSIS BY CHI-SQUARE



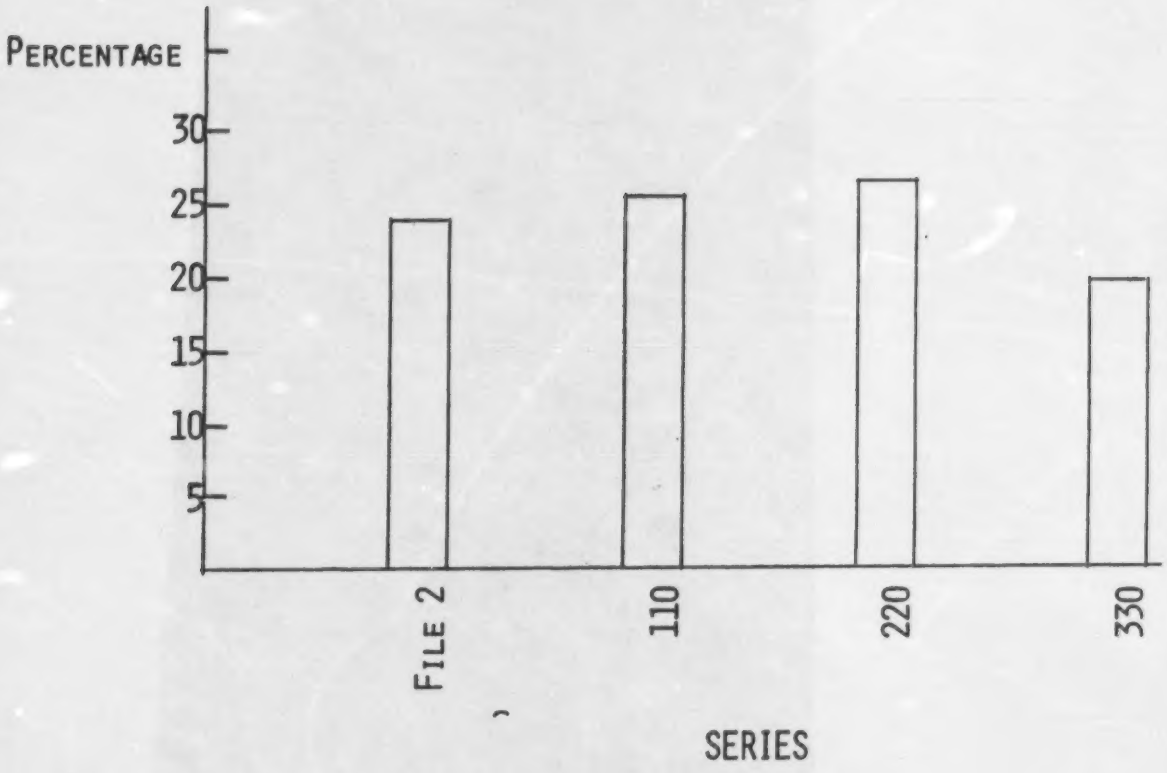
[A]Lack of continuance with equal units intended to enable visual illustration of statistical significant probabilities.

FIGURE 8
SUMMARY OF COMPARISONS WITHIN GROUPS
MATH SKILLS WITH LIKE MATH IN COLLEGE:
ANALYSIS BY CHI-SQUARE



[A] Lack of continuance with equal units intended to enable visual illustration of statistical significant probabilities.

FIGURE 9
PERCENTAGE OF MARS SCORES ABOVE
75TH PERCENTILE: BY SERIES MEMBERSHIP



subgroups. Twenty-four percent of the total group recorded scores at this level and at least twenty percent of each subgroup reached this level with their score. Perhaps, this finding is the primary disclosure of this study and needs further investigation and immediate attention. The findings of this study were combined with findings of the other two studies and general conclusion type statements are presented in session five of this symposium.

Math Anxiety: Conclusions, Discussions, and Remedies

A professional paper presented as Part V

of a Symposium: Math Anxiety: A Research Report

Presenters

Diane Miller and Don Wright

Annual Conference of the

Mid-South Educational Research Association

Lexington, Kentucky: November, 1981

Math Anxiety: Conclusions, Discussions, and Remedies

This session of the symposium presents the investigators' conclusions and suggestions for implementing a math anxiety reduction program. The conclusion statements are based on the review of literature, the findings of the three independent studies and insight gained by the investigators in synthesizing the information and conducting the studies.

Conclusions

1. Group or subgroup membership has little impact on a person's math anxiety unless the group or subgroup membership reflects actual performance of math tasks or an attitude toward math.

2. Persons with high math anxiety perceive their math skills as less proficient than their skills in other academic areas and generally will not like math or like to teach math.

3. Motivation and successful math experiences have a high degree of association with math anxiety; and, have a great impact on the successful completion of math tasks.

4. The actual performance of a math task and the teaching of a math skill to another person are not necessarily equivalent in creating math anxiety for the same individual.

When reflecting on the synthesized information of conducting the studies, the investigators hypothesize that a high degree of relationship exists between the assigned task, the level of skill, the imput of motivation, the degree of anxiety, and the performance of the task. This hypothesis is presented for discussion in the accompanying chart.

DISCUSSION

RELATION OF TASK-SKILL-MOTIVATION-ANXIETY-PERFORMANCE

ASSIGNED TASK	SKILL	MOTIVATION			ANXIETY			PERFORMANCE		
		LOW	AVERAGE	HIGH	LOW	AVERAGE	HIGH	LOW	AVERAGE	HIGH
	<	✓			✓				✓+	
			✓			-✓				✓
				✓		✓				✓+
	=	✓				-✓			-✓	
			✓			✓			✓+	
				✓		✓+				✓
	>	✓			✓				-✓	
			✓			✓+			✓	
				✓			✓		-✓	

1. APPEARS TO BE NO DIFFERENCE REGARDING LEVEL OF SKILL.
2. APPEARS TO BE NO DIFFERENCE REGARDING AREA OF MATH TASK.
3. APPEARS TO BE NO DIFFERENCE REGARDING LIKE/DISLIKE MATH.
4. APPEARS TO BE NO DIFFERENCE REGARDING SELF-APPRAISAL OF TASK SKILLS.

The investigators are proposing that if the assigned math task is less than the individual's skill in math, then the level of motivation received by the individual is reflected in the anxiety expressed and has an impact on the individual's performance of that particular task. If the average performance of the assigned task requires less skill than an individual possesses and there is low level motivation, then there is low level anxiety and this combination will yield an average type performance. However, in the same task/skill matchup, if motivation is increased, anxiety will be increased and performance will improve. This does not imply there will always be a direct linear relationship. As the task and skill matchup changes and the interaction of the motivation and anxiety has influence, the task performance can be increased or decreased. In a situation where the task performance requires more skill than the individual possesses and there is high motivation which creates high anxiety, the task performance is decreased because the high anxiety then actually becomes a hindrance to maximum performance.

Anyone can "suffer" with math anxiety to the extent that the performance of a mathematical task is disrupted. An individual who is prohibited from making good grades in public school, in selecting a college major, in choosing a career, or in receiving a job promotion, because of math anxiety should seek help. One national report suggests that consumers lose hundreds of dollars yearly because of this handicap. Problems include balancing checkbooks, sorting out the best buys at the grocery, calculating a proper tip on a restaurant bill, etc. Educators and educational administrators must accept the responsibility

of helping people recognize their state of math anxiety and then assisting them in abolishing any degree which prohibits them in functioning proficiently.

An educational institution with a high percentage of students in the upper percentile of people suffering with math anxiety should consider offering a Math Anxiety Reduction Program as a part of their over-all curriculum. Such a program should be designed to help reduce a person's level of math anxiety and increase their self-confidence. Programs in existence which have proved successful operate outside the math department, offering a nonthreatening environment in which the participants and group leader can work.

Programs can be designed for any age group or educational setting but certain components are essential for success.

1. Participants must <u>believe</u> that an inability to work math problems is not necessarily an intellectual problem. Behavioral scientists feel that the problems many people have with numbers stem from their attitude toward mathematics, not their aptitude.

2. Participants must be realistic in their expectations of themselves based upon the degree of anxiety they feel.

3. Participants must not be afraid to reveal their anxiety in manipulating numbers, solving word problems, or making everyday judgments based on numbers. A person must first realize a problem, to himself and/or to others, before that problem can be abolished.

4. Finally, each participant must be ready to assume full responsibility in reducing his/her anxiety before success can be experienced.

The following model for a Math Anxiety Reduction Seminar was designed for a post-secondary/adult education program. Slight modifications could make it usable for any level program.

MATH ANXIETY REDUCTION SEMINAR

SESSION I

- Introduction
- Sharing Why They are in the Group
- Anxiety Evaluation (MARS)
- Twelve Math Myths
- Math Autobiography (Explain)
- Explanation of Math Diary

SESSION II

- Discussion of Autobiographies
- Freeing Oneself From the Past
- Three Math Word Problems
  - -Participants Choose One And Set up a Problem
  - -Record Feelings as you Work
- Discuss Solutions & Feelings

SESSION III

- "Math Bill of Rights" (Sandra Davis)
- Math Games We Play on Ourselves and Others
- Math Games Others Play on Us
- Realistic Expectations

SESSION IV

- Tips for Doing Math
- "Sherlock Holmes" Problem
- Role of Intuition in Math
- Discussion of Diary (Up-date)

SESSION V

- Doing Math
  - -Everyday Math
  - -Reading a Math Book
  - -Doing Math Under Pressure
  - -Being Yourself While Doing Math
  - -Tips on Taking Math Tests

SESSION VI

- Problem Solving
  - -Individually or with a grou
- Discussion of Solutions
- Working on Everyday Problems
  - -Brought in by participants

SESSION VII

- Concluding Comments
- Sharing What was Gained
- Anxiety Evaluation (MARS)
- Seminar Evaluation

Epilogue

The papers presented in this symposium illustrate the results of the studies completed by the researchers to date. However, it is not the end, we have not stopped, we have not finished with the investigation. Additional data will be collected in the public schools and from teacher education majors and graduates. The study with college freshmen is continuing but specifically with the developmental math students. This study has been expanded to include additional variables. Efforts will be made by the researchers to launch math anxiety reduction seminars at the public school level and most certainly the university campus. The university based seminar will be available in the Spring, 1982, and will be open to campus students and the adult community.

For a person that is currently involved in or planning to get involved in investigating math anxiety in their local area, we will be honored to share our results and procedures with them and, of course, would like to share in their findings. Any assistance that the researchers can provide is available by phone, by mail, or in person.